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Electrical World

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The winter convention consisted of nine sessions, at which papers on circuit breakers, dielectrics and electrophysics, lightning and transmission problems and solutions, electrical machinery, motors, communication, cable research and progress, and meters and measurements were presented. A report of each session, as well as of the more important points in the ensuing discussion, follows a résumé of impressions of this important meeting.

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A Fruitful Institute Meeting

ANOTHER winter convention of the American Institute of Electrical Engineers has passed and left a record of splendid engineering papers and discussions. This meeting has come to mark the annual peak of technical developments in the electrical art, and more than two thousand engineers are brought together by its meritorious program.

Engineering development never ceases, and, despite opinions to the contrary, the engineering problems to which no answers have been obtained are numerous. The magnitude of the industry and its complexity may obscure the prominence formerly given to these matters, but it is as true today as in the past that the continued progress of the industry rests upon engineering accomplishments.

Several outstanding topics were discussed at the winter meeting. One of these was the problem of circuit interruption, and the announcement of the new "Deion" circuit breaker marks an epoch in development. In itself the new breaker was a remarkable engineering feat, but of more importance is the fact that attention has been focused on new methods for interrupting circuits. Developments will be stimulated because of the inspiration given by a fundamental application of sound principles to a circuit-interrupting device. This does not necessarily mean that the oil breaker has become obsolete, but it does mean a rechecking of designs and of thoughts about circuit interruption, and improvements and new devices are sure to follow.

A second topic of primary importance to the industry was a discussion of dielectrics, especially with reference to underground cables. At best this complex topic remains a battleground, with much to be done before victory can be assured; but opinions are giving way to facts very rapidly. One-idea workers are being supplanted by others with a broader and more fundamental approach to the problems. Good paper, good compound, good joints, good manufacture and good installation are recognized as essential to complete success. Discussions in detail as to the effect of air, moisture, wrinkles in paper, oil reservoirs and the power factors of oil and compounds brought out many very pertinent facts. Through their application an assembled cable of today should be better than one made in the past.

Lightning and the prevention of its bad effects on transmission systems, as usual, came to the front at the winter meeting. The value of properly installed ground wires was substantiated and more data from field and laboratory were brought forth. But fundamental progress is slow and the entire industry would do well to focus all test facilities and expert experimenters on field and laboratory work. Too many individual groups now labor without co-ordination, and controversy arises because of a desire to support group opinions and theories. It is to the advantage of all that facts be had, and the industry can do much to expedite the development of the facts on a co-operative basis. Opinions about the effect of the fronts and tails of waves should give way to exact data. The industry must know the way to build a lightning-proof line or, if this be uneconomical, how to install relays and breakers on multiple lines to give service despite lightning.

Other developments were the announcement of a new type of transformer winding that will not oscillate, a line of small motors using condensers to improve their characteristics, new radio applications for safety in aviation and new metering devices and methods.

Social features received due attention at the meeting, and the presentation of the Edison medal to Dr. Frank B. Jewett provided an occasion which the entire industry welcomed to do honor to the worthy and popular recipient.

The Institute is doing splendid work, and the engineers find in its fold a welcome rallying place. It must not be forgotten that facts are difficult to find in this changing world and that the greatest stimulus to research and development often comes through personal pride of opinion. Engineers are strong individualists. The dynamic urge that leads them into controversies to support their opinions is a symptom of the force that makes them productive. Debates and discussions stimulate development, and the record of the winter convention last week contains very many "behind the scenes" ideas and personal opinions that will be productive of much that is new in the coming years.

* * * *

Ratification of the Niagara Convention Desirable

REMEDIAL works for the protection and enhancement of Niagara Falls are provided for in a convention and protocol with Canada awaiting ratification in the Senate. The plan, which is that of government engineers and which has been indorsed by the American Scenic and Historical Preservation Society, calls for excavations and submerged weirs across the current of the Canadian falls along both flanks of the Horseshoe. The work is to be carried out under the supervision of the United States and Canada by and at the expense of the Hydro-Electric Power Commission of Ontario and the Niagara Falls Power Company. For the purpose of determining the efficacy of the remedial works the convention provides for a temporary diversion of water on each side of the river during the winter or non-tourist season. The water temporarily diverted will be granted to the power companies in lieu of cash compensation.

The junior senator of New York has asked the Gov-

ernor of the state for advice on the matter. State development of water power is being sought by the Governor; but inasmuch as no new development is involved at Niagara and the additional water is available only during the winter months, it is doubtful whether any good reason can be brought against the proposal. When the remedial works shall have been completed and the temporary diversion of water shall have been ended the whole matter will automatically come up for action. Then the question of state versus private development can be thrashed out and settled. Meanwhile the scenic grandeur of Niagara Falls needs to be safeguarded against the depredations of nature itself. That is the pressing problem, and unless Canada and the United States or Ontario and New York wish to undertake the work themselves at public expense, the present agreement should be accepted. It has the advantages of involving no public expense whatsoever and, what is more to the point, of speedy action.

* * * *

What Are the Opportunities for Lower-Cost Stations?

RECENT discussions on power-plant economies indicate that the trend of thought is turning toward the problem of building power plants of lower initial cost. Executives will undoubtedly demand a more careful analysis of every feature of a new station's design to see if first cost is as low as good operation will permit. While the total cost of the steam section of power plants has tended to decrease relatively over a period of years, the cost of the electrical section, with its more elaborate switch gear, transformers and other devices, has tended to increase relatively. It would therefore seem that the electrical section of the plant should receive particular study in the search for lower investment cost.

In the older station's switchgear, protective devices, transformers and so on were housed in buildings at considerable expense. The outdoor switching and transformer stations effect a material reduction in plant cost when plenty of land is available. A recent large hydro-electric plant placed this equipment in the open on its roof.

European engineers, who must exercise the strictest economy in plant design, are giving considerable thought to cost reduction in the electrical section of their stations. C. A. Parsons & Company, the well-known British turbine builders, have recently furnished a turbo-alternator for the Brimsdown plant, one of the larger London central stations, which operates at 33,000 volts at its terminals. The majority of large American units operate with voltages between 12,000 and 16,000. The British unit can deliver energy directly into the local distribution system, and the cost of transformers, their housings, foundations and switchgear is thereby saved. The saving should exceed any added cost of construction of the generator for the higher voltage and will also effect a large saving in space requirements.

This is a distinct step in the right direction toward simplifying the electric plant and reducing power-station investment. Further study may indicate the possibility of using still higher voltages in turbo-alternators. There may be other methods developed by which the electrical engineer can do his share in meeting the increasingly insistent demand for lower investment in central power plants. If so, open discussions of the subject would be very helpful.

Service Reliability of Transmission Links

SERVICE reliability is the cause of considerable capital expenditure, and therefore every possible means of determining the reliability factor of the various units or links in a utility system should be used. One of the big problems in this field is to fix the reliability of a transmission circuit.

Local conditions, such as storms and physical exposure to hazards, modify any general data, but it would seem possible to get statistical information that would give some measure to be used in design. Properties which are not already doing so might well keep service records on each unit of a line indicating the number of complete and partial interruptions. Knowledge based on several years' records that thirty or forty interruptions may be expected per year on each 100 miles of 110-kilovolt line affords a better basis for new construction than an assumption of sixty or ten interruptions made respectively by a pessimistic or an optimistic designer of lines. The number of lines needed to give a desired continuity of service can well be gaged by statistical data on line interruptions. Local modifying factors such as storm paths can be used to arrive at a conclusion far more accurate than one reached on a basis of guess. When dollar values are considered it will be found well worth while to keep statistics on line interruptions.

* * * *

The Modern Lotus Eaters

CONVENTIONS soon become, for the habitué, of a deadly and unfortunate sameness. Some of them are, however, distinguished by the extreme significance of the material discussed, others by the importance of the deliberations to the immediate industry involved, others by the prominence or ability of the speakers, and still others by that intangible element called character. One is never at a loss at a meeting of the American Institute of Electrical Engineers to detect in the mingling of the other elements the dominant character of the mental attitude of the members. It sometimes seems that no other class of engineer can be getting quite so much enjoyment out of his work as the electrical engineer.

There were youngsters—and assurely they were little more than that—at the A.I.E.E. convention last week who discussed and presented papers on fearsomely involved subjects with assurance and enthusiasm. Research electrical engineers tend to a physical type. One might almost pick them out in a crowd. They are men who have invented a rather fascinating game of unending delight for themselves. It takes a rather special sort of mind to wander in the abstractions of mathematical symbols and concepts, tie them in with practical things and yet find them as real and interesting as others find more material things.

Each new era is builded on its predecessor. To deny evolution is as absurd as to fight it. The young men who today are solving the incredibly complicated and little understood problems which arise in connection with every new development in the electrical industry are of a strange new breed. Fifty years ago such men were seldom seen. Introspective, not notable for physical strength or stature, often tired-eyed, and yet enthusiastic and unwearying, you will find them. When they dream

they may seem to be the modern lotus eaters. But the stuff their dreams are made of is not induced by jujube, poppy or mandragora. They sleep with their eyes wide open. The game is that of intangibles which by a finer sort of miracle are so closely related to material things that highly practical people are willing and able to watch and aid them in carrying on.

* * * *

Value of an Expert on Wood and Its Preservation

ELECTRICAL men give great attention to the design of steel structures and to the characteristics of steel. Wood, on the contrary, is more or less accepted as a construction material without thought of its qualities or of methods used to preserve it. With the diminished supply of timber several processes for preserving wood that are economical have developed. Creosote as a preservative is commonly used, and recently zinc, arsenic and combinations of zinc and arsenic have been advocated as good preservatives.

Wood is a complex structure that varies widely among different species of trees, and an intimate knowledge of the technology of wood is needed to deal with its preservation and with the intelligent design of wooden structures. Preservation of wood is a specialty about which fundamental data are meager. Organisms cause rot, and these organisms must be nurtured to grow. A preservative is designed to prevent the growth of these organisms, and experience shows that certain materials are effective in greater or less degree. From an economic point of view it is desirable to get the greatest amount of preservation per dollar expended.

The over-all economic life of a wooden pole or of a wooden structure can be determined with measurable accuracy by a student of wood and its preservation. Electrical organizations using quantities of wood will be repaid by having on their staff a man trained in the technology and preservation of wood. An engineer, after some study of the subject, can be relied upon to develop the knowledge essential to the economical and intelligent use of treated wood.

* * * *

The Future of Line-Start Motors

UNANIMITY of opinion expressed by those attending the induction-motor session at the A.I.E.E. winter convention last week indicates that one may well foresee some changes in the rules governing line-start induction-motor practices. The rules of the N.E.L.A. have been redrafted previously to conform with the demands of customers and to agree with better knowledge on the subject, but it appears to be high time that this highly important subject should have further consideration.

The objection to line-starting practices centers in the possibility of impaired service, and utility men are more than a little jealous of the fine records that they have maintained for freedom from interruptions and fluctuating voltages. A number of instances were cited at this meeting in which such equipment as 2,400-hp. motors were started without compensators, in which 700-kva. and 800-kva. starting loads were thrown on 350-kva. capacity transformers, and in which 100-hp. motors were connected directly to the line in a metropolitan area. All of these things were accomplished without apparent detrimental action to the service furnished other consumers on the power company's lines. As was pointed out by C. W. Franklin of the United Electric Light & Power Company of New York, all cases cannot be evaluated on the same basis. On certain circuits the 100-hp. motor started across the line might produce very little annoyance, while a 10-hp. motor would be an objectionable feature because of flickering lights.

As in every similar situation, there is "much to be said on both sides," yet it is evident that when a sufficient number of engineers or customers or utility men desire a revision of the rules which will permit larger motors and heavier starting currents the rules will be revised to meet the demands and the engineering difficulties will be ironed out. Design engineers in speaking at this meeting were careful to point out that the performance characteristics of the motors complying with N.E.L.A. standards fall far short of what is desirable and practicable, owing to the limitations imposed by the outmoded N.E.L.A. starting-current rules. An adequate motor-starting rule must consider the capacity of the service facilities to which the motor is connected as well as the service requirements of other equipments.

* * * *

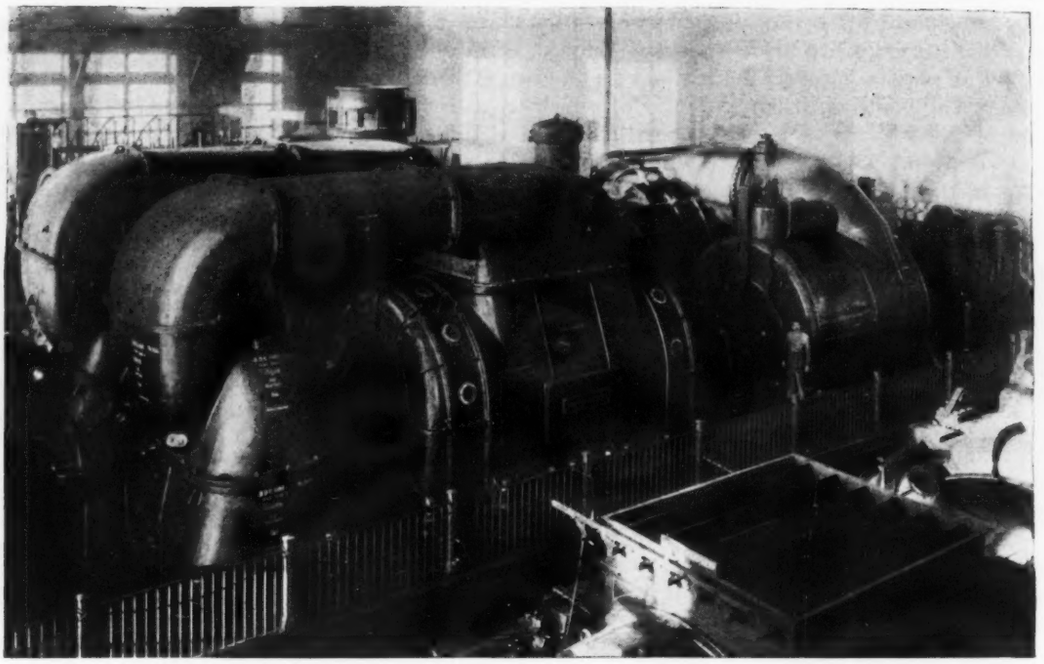
Radio Commission Loses Caldwell

ANNOUNCEMENT that O. H. Caldwell will not seek reappointment to the Federal Radio Commission presages the passing of the only qualified radio man remaining on that board. Messrs. Robinson and Sykes are able jurists and Mr. Lafount is a good business man, but they lack the technical radio background that might enable them to satisfy the six hundred squabbling broadcasters, the ten thousands concerned in commercial accounts and some fifty million radio listeners.

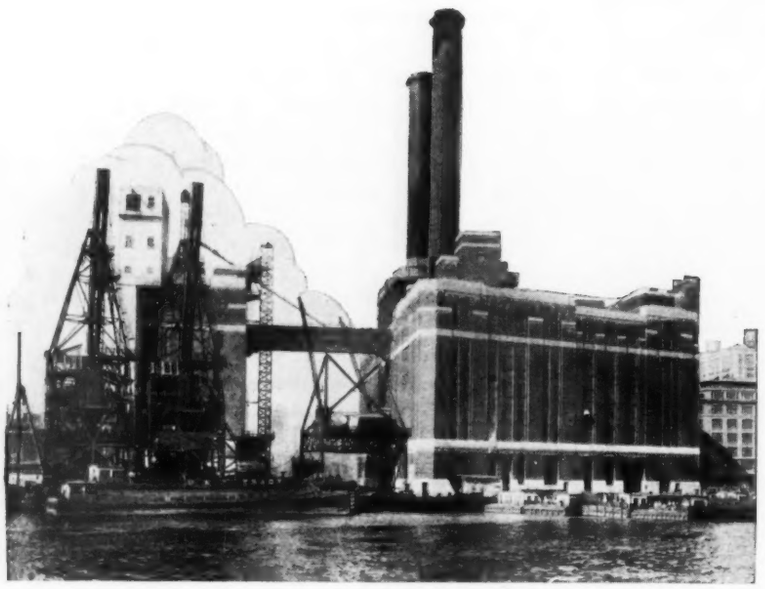
Stock taking on the work of the commission leads to the conclusion that it has done good work, especially when it has had competent radio engineers as members. But the usual political course has been taken, and in consequence its competency or usefulness in dealing with future radio problems may be questioned seriously. The fight of Commissioner Caldwell for higher power and cleared channels has been almost single-handed. He was outspoken in his condemnation of the Davis amendment and in his defense of chain broadcasting. He vigorously defended utility broadcasting stations that gave service and bluntly told a congressional committee that the commission plan is ill adapted to the problem of administration. Competent technical radio men are apt to shy away from the political and non-professional atmosphere surrounding the work of a government commission dealing with a technical industry, yet Commissioner Caldwell, by his record, has faced these handicaps courageously and has rendered noteworthy public service under difficulties. It is doubtful whether an equally able and competent man can be prevailed upon to serve on the commission under present conditions or would be appointed if available.

Some comment has been made to the effect that a board composed entirely of political appointees would be the best instrument to bring public dissatisfaction to a head and thereby cause a new approach to the national radio situation. A common-sense law and a competent administrative staff are not necessarily associated with a political commission. Why not try a federal department?

Three 160,000-Kw. Generating Units for New York



Brown-Boveri unit at Hell Gate



East River station

THE assembly of the Brown-Boveri 160,000-kw. turbo-alternator, consisting of a high-pressure, single-flow turbine and a low-pressure, divided-flow turbine, has been completed at the Hell Gate station of the United Electric Light & Power Company. A Westinghouse unit of similar capacity has been almost completely assembled at the same station.

At the East River station of the New York Edison Company there will soon be a third 160,000-kw. unit of General Electric design.

A.I.E.E. Convention

Appeals to Many

New circuit breaker. Lightning protection. Preventing cable breakdown. Value of capacitor motors. Non-resonating transformers. More scientific commutator design. Radio for guiding air traffic

OPERATING men, manufacturers' representatives and research investigators had an excellent opportunity to find something of interest in practically every session of the A.I.E.E. midwinter convention last week. Not only did the papers and discussions cover a wide field of activities, but many outstanding subjects were considered. Great progress was shown in appealing to scientific, design and operating interests by the more balanced attention given each group.

Unlike some conventions, this one had more than one or two sessions or papers of importance. Studies of lightning and protective measures, results of further research into the mechanism of cable breakdown and methods of preventing it, developments in high-speed circuit breakers, particularly the "Deion" breaker and experience therewith, performance and economy of the capacitor induction motor, prevention of excess voltages in transformers by a non-resonating construction, and physical tests that place commutator design on a more scientific basis were among the subjects which commanded most attention. Standard test voltages for initial installations and radio beams as guides for airplanes were also discussed.

LIGHTNING voltages remain the greatest single hazard to transmission line service. Knowledge of lightning must be had before decision can be made as to the relative economics of building lightning proof lines or of building systems with adequate breakers and relays to protect against lightning. In a paper on lightning experiences on actual lines Philip Sporn showed that 30 interruptions for 100 miles of circuit per year was not out of line, yet other lines, where concentrated effort was made to prevent troubles, showed a performance of only four interruptions per 100 miles per year. The ground wire has become accepted as a valuable aid in lightning protection when properly installed and maintained, but debate is still had about the fundamentals of lightning.

Field investigations of lightning can now be made by use of cathode-ray oscillograph, high-speed cameras and the klydonograph. But up to date insufficient data are available to give conclusive proof of the range of waves to be expected from cloud discharges or data concerning steepness, polarity, duration and attenuation. Two or three schools of thought exist as to lightning flashover phenomena and protection against lightning and some time must elapse before data can be had to clarify the situation.

ANY fundamental study of dielectrics is surrounded by so much complexity that little knowledge can be had. But, by empirical methods, underground cables have been developed and improved and, little by little, fundamental knowledge has been had.

At the cable sessions at the midwinter meeting the value of the shielded cable was conceded, it was recognized that air in some small amounts was not deleterious, it was found that oil would not flow from gravity reservoirs along wrapped cables and it was realized that joints must be strengthened to withstand pressures. A good cable must be impregnated fully at all times for best service and the limitations of short-time voltage tests and power factor tests were outlined. Application of the dipolar theory to cables was an encouraging theoretical step, even though this effect is very minute at low frequencies. Much remains to be done with paper, with oils and compounds, with mechanical features of manufacture and with service uses of cable, but progress is being made and the attacks on unknown factors are more carefully organized than ever before.

In what follows are presented brief abstracts of the convention papers and outstanding comments made in discussion thereof.

Circuit Breaker Development

ENTHUSIASTIC commendation of the "Deion" circuit-breaker development was voiced by operating engineers at the session on protective devices, following a presentation of the theory, construction and field experience. Some questions were asked regarding its limitations, and the nature of characteristics that might be further investigated were suggested. While several representatives of competitive manufacturers commended the scientific attack of the circuit-rupturing problem, a few inferred that just as good results can be obtained with apparatus already on the market. A large part of the discussion was devoted to comments on some of the interesting phenonema observed, and some supplemental information was presented indicating the possible suitability of this breaker to duties not specifically covered in the former papers.

P. H. Chase, Philadelphia Electric Company, said that few papers have been presented which give operating engineers a vista of such radical developments and possibilities. It represents a determinate attack on an important problem and a willingness to accept new theories. Long-desired advantages are promised. Among the outstanding benefits anticipated are reduced life and liability hazards, lower insurance rates and reduced need of isolation, all made possibile by the elimination of oil. Less inspection and maintenance are expected. The high rupturing speed, declared Mr. Chase, will permit the more effective application of selective relaying and assure greater system stability. Greater hope of clearing insulator flashovers before damage occurs is seen.

S. M. Dean, Detroit Edison Company, supported Mr. Chase in all his statements and emphasized the advantages of speeding up the rupturing operation. Another benefit expected is that executives can be given a more tangible idea of how long the investment in breakers may be useful and can be shown that a vital problem is being attacked basically. The question was raised whether the rupturing duty would be limited to 500,000 or 750,000 kva. Attention was called to the fact that fibrous insulation should be eliminated wherever possible from high-voltage equipment due to the troubles caused by moisture.

Mr. Veile, Pennsylvania Railroad, expressed great interest in any circuit breaker which would eliminate oil and reduce the attendant hazard, particularly in unattended substations. The value of high speed of rupturing was also emphasized, although he warned of the possibility of excessive voltages being induced if large currents are ruptured in less than one-half cycle.

Several General Electric engineers paid compliments to Westinghouse research engineers for the way in which they had tackled the problem, although they contended that the originality was shown in the new combination of old principles, rather than in the use of new principles.

J. W. MacNary declared that the results indicated that some other action than deionization of the cathode film is apparently responsible for the action, and questioned the ability of breaking small currents and particularly low power factor circuits, the first because of the reduced effect of the blow-in coils, and the second because of the non-coincidence of the voltage and current waves. It was suggested that the possibility of an arc re-establishing due to the metallic vapor produced be investigated. It was also questioned whether the number of parallel arcs produced by heavy current might not offset the attempt to maintain cool cathodes. The speaker referred to a high-speed air breaker now on the market which successfully ruptured 12,000 volts and 25,000 r.m.s. amp. without employing excessive separation of the arcing contacts by a combination of parallel arcs and rapid cooling.

R. M. Spurck called attention to the need of performance data when small currents or charging currents are ruptured; also information on the reliability of the deionizing chamber in maintaining a gap between terminals when the circuit breaker is open, the 60-cycle break-down voltage of the deionizing chamber under these conditions immediately after a large current has been interrupted, and the possibility of interrupting a circuit between two 15,000-volt systems when they fall out of synchronism due to increased voltage involved.

A discussion was presented from Mr. Hilliard, General Electric Company, saying that comparisons between the "Deion" breaker and other breakers should be made on comparable bases because the magnitude of the recovery voltage is dependent to a large extent on the system. He also maintained that oil circuit-breakers can be repaired more easily than the air-break type. Some skepticism was expressed regarding the ability of the "Deion" breaker to perform at high voltages if ionized gas is ejected from the deionizing chamber.

K. B. McEachron, who referred to the novel combination of old ideas, pointed out that some of the principles have been used in lightning arrester development. He also pointed out that the race between deionization and restoration of voltage is particularly close at low power factors when the voltage peak occurs near the normal current zero.

F. C. Hanker, Westinghouse Electric & Manufacturing Company, paid a tribute to the early studies of Dr. Slepian regarding the principles involved in the extinction of an arc,

Theory of the "Deion" Circuit Breaker

J. SLEPIAN, Westinghouse Electric & Manufacturing Company.

Development of the "Deion" Breaker

C. R. DICKINSON and B. P. BAKER, Westinghouse Electric & Manufacturing Company.

Field Tests of the "Deion" Breaker

B. G. JAMIESON, Commonwealth Edison Company.

Features of the three foregoing papers were presented in the Feb. 2 issue of ELECTRICAL WORLD, where the general principles of the new breaker were described and particular emphasis was placed on laboratory and field research.

Automatic Reclosing High-Speed Circuit Breaker

A. E. ANDERSON, General Electric Company.

Reclosing action is, with this type of equipment, ordinarily obtained through a relay which, with a load indicating resistor, measures the resistance of the external circuit. The action of this relay is delayed in order to permit feeder conditions to reach a stable value and particularly to enable all transient and counter emf. effects to disappear before the reclosing devices are given control. A time delay of 10 to 30 seconds is involved. A majority of such 3,000-volt installations have been made in connection with main line electrification where the desired reclosing operation is a combination of load-indicating and load-limiting functions.

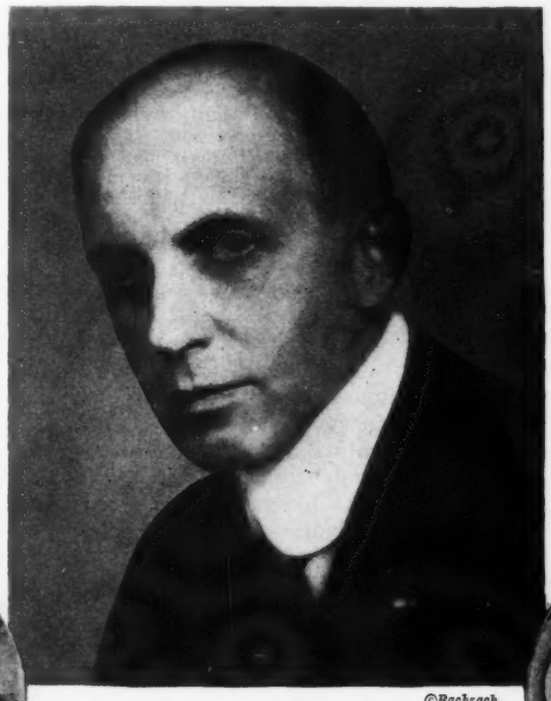
admitted limitations of oil circuit breakers with present concentrations of power, and pointed out that all developments in oil circuit breakers up to the present time have not shown any radical development in principle, whereas the "Deion" breaker is a scientific development which requires relatively small space compared with the high-speed air breaker having an arc chute.

J. B. MacNeill, of the same company, reported having conducted tests with the new breaker on 2,500-volt circuits, and announced the construction of six single-pole "Deion" breakers for field experience in one of the Commonwealth Edison substations. He expressed the opinion that the new breaker is adaptable to 11,000 or 12,000-volt railroad circuits. Within a year field data are expected to be available on 25,000-volt operation. Tests have been made with small currents. Constancy of operating performance was emphasized as a feature of the new breaker. Some by-products have been made available through the development of the breaker, which are equally interesting and should save other investigators money in circuit breaker research, according to the speaker.

B. P. Baker of the Westinghouse company referred to some supplementary data on the new breaker, indicating its suitability for rupturing small currents. Around 2,000 amp. can be ruptured in about one cycle and 1,000 amp. in 1½ to two cycles, while very small currents may take up to one second to rupture because of the reduced effect of the blow-in magnet, although its action can be magnified. Highly inductive circuits cause longer delays in rupturing. When used in circuits containing high capacitance, currents of 16 or 17 amp. may be ruptured in one-half cycle, but the arc may be re-established by opposition of voltages. When no arc is present in the deionizing chamber each gap can withstand 1,000 volts, declared the speaker, so there is no need of an air disconnecting switch in series with the breaker for safety on moderate-voltage circuits, although one may be added for breakers developed for high voltages. Sixty-cycle break-down tests on a 15,000-volt deionizing chamber show a value around 50,000 volts.

In closing the discussion Dr. Slepian pointed out that even more satisfactory performance could be obtained with the new breaker if the arc could be kept out of the deionizing chamber until the normal current wave passes through the zero value. He also showed that the voltage required to re-establish an arc in the thin film adjacent to the cold cathode becomes larger as the ratio of the cross-section of the arc to the

Awarded Edison Medal



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Dr. Frank B. Jewett

"The Gold Medal has been awarded to Frank B. Jewett for his contributions to the art of electrical communication."

As transmission and protection engineer of the American Telephone & Telegraph Company, Dr. Jewett was responsible for the introduction of phantom loading, loading of large gage and open wire circuits, the practical use of telephone amplifiers and the development of phantom duplex cables.

Dr. Jewett is now vice-president, in charge of development and research, for the American Telephone & Telegraph Company and president of the Bell Telephone Laboratories, Inc. He was formerly president of the A.I.E.E.

length of the path is reduced. If the area of the cathode is large and the gap very short, the break-down voltage is practically constant, he maintained. If arcs are confined to slots or holes, limiting the cross-section, the break-down voltage can be increased.

Although temperatures of from 300 to 400 deg. are momentarily caused at the points of contact between the arc and the plates, they drop equally rapidly. With the amount of metal now used in the deionizing chamber currents of 20,000 and 25,000 amp. may be ruptured many times with satisfaction. When the breaker ruptures the circuit between two systems which are falling out of synchronism the rise in voltage is relatively slow compared with the rate of deionization, Dr. Slepian declared. The deionizing chambers for higher voltage circuits may be cheaper to construct because it is the magnitude of the current rupture which requires the construction used for present breakers. More qualitative and quantitative data are needed regarding the maintenance and extinction of arcs, Dr. Slepian pointed out in closing.

The paper on automatic-reclosing high-speed breakers was discussed by C. Lichtenberg, General Electric Company, and F. C. Hanker. The former pointed out that the high-speed breakers described are apparently suitable for alternating-current up to 15,000 volts. Time of operation has had to be carefully studied by dividing it into its components: Relays, unlatching, parting of contacts and distending of arc. Some 11,000-volt, 25-cycle circuits have been opened in one cycle.

Mr. Hanker pointed out that the purpose of high-speed breakers is different in a.c. and d.c. circuits. In the latter they are principally to protect the rotating equipment from flashing over at the brushes. He questioned whether the expense of such breakers is justified for this purpose when simpler equipment requiring less inspection and maintenance can be used effectively to suppress the voltage and avoid flashover. In a.c. circuits high-speed breakers are desirable among other reasons to limit the duration of disturbances which will cause telephone interference.

In closing the discussion A. E. Anderson declared that early forms of the high-speed breaker had been in service ten years without excessive maintenance.

Dielectrics and Electrophysics

Anomalous Conduction as a Cause of Dielectric Absorption

J. B. Whitehead and R. H. Marvin, Johns Hopkins University.

Dielectric absorption, considered as the origin of dielectric loss and the probable cause of deterioration and short life of composite high-voltage insulation materials, was investigated. Short-time absorption curves were recorded by means of the string galvanometer. It was found that dielectric absorption is purely a conduction phenomenon; conductivity of dielectrics is highly anomalous in character; no existing theory, including Maxwell's, can account for the variations, and temperature elevation increases conduction.

Flux Linkages and Electromagnetic Induction

L. V. Bewley, General Electric Company.

Flux linkage may be varied in two very different ways, either the flux may be changed, causing a voltage to be induced, or the turns may be altered by a substitution of circuit without inducing a voltage. It is possible to identify these two elements in every direct-current machine. Flux linkages that occur in electrical circuits have been classified with respect to the type of voltage generated in familiar apparatus.

Power Factor and Dielectric Constant in Viscous Dielectrics

Donald W. Kitchin, Simplex Wire & Cable Company.

The peculiar variation with temperature and frequency of the dielectric constant and power factor of rosin, rosin oil and castor oil has been investigated. The Debye dipole theory attributes the anomalous change not to impurities or heterogeneity of structure but to molecules containing electric doublets which try to orient themselves in an electric field. The rotation of dipole molecules in a viscous medium is seen as giving rise to frictional heat loss expressed as power factor.

Corona Ellipses

Vladimir Karapetoff, Cornell University.

An exposition of the mathematical theory of the cyclograms of corona obtained by a cathode-ray oscillograph. As long as the sinusoidal amplitude of the applied voltage is below the visual corona point the charging current is also sinusoidal and the oscillograph record is therefore an ellipse. When, however, the minimum ionization voltage is exceeded during part of each alternation, the cyclogram ceases to be an ellipse, but consists of four portions, two corresponding to absence of corona and two to its presence and short transients.

IN DISCUSSING the paper of Messrs. Whitehead and Marvin, E. R. Thomas cited the example of two condensers placed in series with different values of resistance across each, the combination being energized by a battery. Immediately after the first short-circuiting and then opening the circuit zero voltage appeared across both condensers. Later, however, due to unequal leakage resistances, one condenser proved not to be fully discharged. This phenomenon is analogous to that occurring in practical insulation where the energy stored in the dielectric builds up voltage after the conductor has been discharged, and shows the necessity of shorting cable a considerable period after testing with direct current.

F. M. Clark suggested that liquids have less absorption than solids or gases.

G. F. Kennedy stated that oxidation effects and water content of compounds affect the dielectric characteristics of the materials.

H. Halperin described a test installation of six 1,000-ft. lengths of 132-kv. cable with which the Commonwealth Edison Company has experimented. Some of these cables were oil insulated and some were not. A direct current of 200 volts was used. It was found that the charge curves were higher than the discharge curves for these cables.

R. W. Atkinson stated that a few years ago power factor and conduction of a dielectric was considered more important than its absorption characteristics, the latter once being classed with the "left-over" losses. These losses may become cumulatively of more and more importance.

Dr. J. B. Whitehead stated the dipole theory was an interesting development that had a wide field of application in high-frequency phenomena. But with the low-frequency conditions of underground cables and with the composite dielectrics used there was doubt that the effects discussed by Dr. Kitchin could be found. Some other explanation of absorption phenomena in cables was needed.

Lightning Research

Lightning Experience on the 132-Kv. Transmission Lines

PHILIP SPORN, American Gas & Electric Company.

Lightning Research

F. W. PEEK, JR., General Electric Company.

Power Transmission and Distribution

CONCLUDING REPORT OF 1927-1928 COMMITTEE.

Outstanding points in the three foregoing papers were presented in the February 2 issue of ELECTRICAL WORLD, where emphasis was placed on definite laboratory and field experience.

A Graphical Theory of Traveling Electric Waves Between Parallel Conductors

VLADIMIR KARAPETOFF, Cornell University.

The disadvantage of past analytical expositions of simple traveling waves along parallel conductors is that the relationships among the incoming, reflected, transmitted and absorbed currents and voltages are expressed by a number of simultaneous equations difficult to grasp in their entirety. A graphical theory using the star diagram in which the whole phenomenon is conveyed to the eye quantitatively is offered for several cases of a simple rectangular-front, non-attenuated, long, traveling wave.

Theoretical and Field Investigations of Lightning

C. L. FORTESCUE, A. L. ATHERTON and J. H. COX, Westinghouse Electric & Manufacturing Company.

Particular reference to investigations in Tennessee with the Norinder form of cathode-ray oscillograph with further consideration of the theory of traveling waves along transmission lines. Reflections at open and grounded ends are considered. A mirror scheme of an infinite series of waves on a double infinite line equivalent to actual waves along a finite is developed. Production of surges on lines and effect of ground resistance are also discussed.

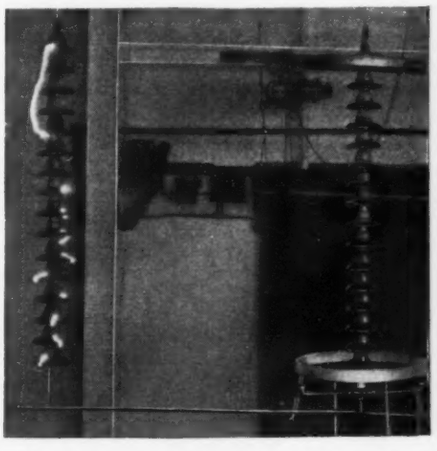
BOTH laboratory and field research results were brought out in the discussion of the papers on protection against lightning, which showed a greater appreciation of coordinating these two forms of investigation than ever before. As expressed by K. B. McEachron, the desired conclusions would be slow of attainment if investigators had to depend on observations of the effects of natural lightning, but the recording of field experiences is essential to the establishment of laboratory set-ups that will simulate field conditions. He advised that surges reproduced artificially can be of the same shape as those actually encountered.

J. H. Cox cautioned against attaching too much finality to F. W. Peek's observations as much still remains to be learned. The surge records usually secured, he claimed, are attended by flashover and they probably occur on the head of the wave and therefore not much is known about the tail of the surge. There is said to be but two pictures of lightning on record and these are inadequate to draw any useful conclusions. Mr. Cox advocated the use of ground wires above conductors.

J. J. Torrok questioned a statement that surges are dissipated in one span, citing instances in which it required 8 miles of line to reduce a 900-kv. surge to 700-kv. He claimed that the lightning generator described by Mr. Peek is basically the same as the Westinghouse generator.

Professor C. F. Harding expressed the opinion that the papers prove more positively than ever the superiority for field research of a cathode-ray oscillograph in which exposures are initiated by the surge. He and J. R. Eaton, Consumers Power Company, referred to an oscillograph, not affected by gas pressure, which can be loaded with films without breaking the vacuum, is operable from a 60-cycle, 110-volt source and has a 500,000-cycle oscillator for producing a timing wave. Mr. Eaton claimed that some of the distortion of wave shapes might be due to reflection from the ends of transmission lines.

H. Halperin, Commonwealth Edison Company, urged the collection of more oscillograms of actual lightning surges before reaching conclusions regarding their characteristics. He emphasized the need of studying the protection of distribution circuits because outages thereon affect service more than transmission disturbances.



Shielded and unshielded insulator strings under lightning impulse (Peek)

The question was raised whether lightning may consist of multiple flashes rather than single flashes. If so, the effect may be different than assumed.

H. D. Flóyd, Hydro-Electric Commission of Ontario, emphasized the small amount of data regarding the magnitude of surges at terminal apparatus and suggested that attempts be made to avoid the divergence of opinion of some eminent research men, stressing the danger of basing conclusions on too few observations.

The apparent lack of uniformity in the information available from various manufacturers was deplored, it being stated that a buyer is in a most difficult position because of the apparent diversity of data given on the same subject.

The results of actual tests with ground wires on some of the 132-kv. circuits of the Public Service Company of Northern Illinois, extending over a period of two or three years, were given by C. E. Ampelang. These tests showed that the use of ground wires reduced very appreciably the number of interruptions. They have experienced almost as many flashovers on unguyed wooden poles as on guyed poles.

E. S. Lee related a human-interest story of attempts to secure records of natural lightning surges on the Wallenpaupack line of the Pennsylvania Power & Light Company. A transient was pictured which reached its peak in five microseconds and endured 40 microseconds. According to records taken at intervals along the line the maximum potential induced was approximately 2,160 kv. and this

was reduced to half value in about 4 miles. Although the potential dropped off rapidly an increase over the adjacent potential was observed at the terminal apparatus.

Percy Thomas expressed the belief that only the front of a transient is affected by lightning and that the tail is influenced more by line characteristics which fix the rate at which the bound charge is drained off before discharge.

E. F. W. Beck agreed that while great progress has been made in the study of the lightning phenomena there is need for more information before a lightning-proof line could be built.

Closing the discussion, Mr. Cox commended laboratory tests for their greater precision and possibility of repetition, but declared field tests must be made their basis. To avoid subjecting actual lines to hazards full-size models can be subjected to artificial transients. Mr. Peek attributed criticisms of his paper to superficial reading and demonstrated his contention by quoting passages and referring to his 1915 paper.

Electrical Machinery

THE relative amounts of discussion which different papers receive at conventions is not always a measure of their relative importance, but seemed to be a very good measure in the session devoted to electrical machinery, where K. K. Palueff's paper on the "Effect of Transient Voltages on Power Transformer Design" attracted maximum attention. The papers by C. M. Gilt and B. L. Barns and by F. T. Hague and G. W. Penney ranked next in the amount of discussion provoked. One of the greatest points of interest which Mr. Palueff brought out was that parts of power transformer windings may be subjected to as much as 80 times the normal stress impressed on them by the oscillations set up by lightning and switching transients, but a very simple shielding method has been developed which can be applied to most any standard power transformer without modification of construction to permit more scientific utilization of the insulation.

The paper was referred to by J. F. Peters of the Westinghouse Electric & Manufacturing Company as a very interesting review of the voltage stresses across transformer windings; by E. H. Branson of the General Electric Company as very impressive because it shows a method of reducing stresses as much as 80 to 1, by Philip Sporn of the American Gas & Electric Company as the most commendable application of principles which have been observed in radio, but until now ignored in power equipment; by F. W. Peek, Jr., as a very opportune investigation because strengthening of transmission line insulation has required the strengthening of terminal equipment, by V. Montsinger of the same company as helping the correlation of transformer insulation with the rest of the system.

However, Mr. Peters expressed the opinion that the use of the shields suggested by Mr. Palueff on the outside of interleaved pancake coils will not improve the voltage distribution next to the core and questioned the seriousness of abnormal voltages produced. According to tests with one-quarter microsecond waves 4 to 75 miles long, Mr. Peters declared that the excessive voltages produced occurred on the line end of the winding, which can be easily insulated. On the other hand, Mr. Branson maintained that it is dangerous to grade the insulation if oscillations subject the intermediate points to great overvoltage.

Mr. Sporn deplored the fact that power engineers have not considered some of the principles observed in radio research for they may be applicable to power equipment. Illustrations of some of the shielded nonresonating transformers, described by Mr. Palueff, were illustrated, which showed a ratio of thirteen to sixteen in the height of shielded and unshielded transformer tanks of the same 132-kv. rating.

Inductance can become a capacitance under transient conditions, de-

Two-Reaction Theory of Synchronous Machines

R. H. Park, General Electric Company.

No saturation and distribution of approximately sinusoidal armature phase m.m.f. have been the assumptions under which general formulas for current, voltage, power and torque under steady and transient load conditions have been developed. In this analysis the treatment has been generalized to include salient poles and an arbitrary number of rotor circuits.

Transient Analyses of A. C. Machinery

Yu H. Ku, Massachusetts Institute of Technology.

Heaviside's operational methods may be applied to determine the transient currents that are produced in synchronous and induction machines by some sudden alteration of their electric circuits. Observed and computed values have been plotted for a number of cases.

Effect of Transient Voltages on Power Transformer Design

K. K. Palueff, General Electric Company.

When a transient enters a transformer the windings act first as plain capacitance, then as inductance developing voltage oscillations on each side of the steady-state voltage stresses. As a result large overvoltages occur, the percentage increase being greatest on the ground end. By applying shields over the windings a non-resonating transformer has been developed that has practically the same voltage distribution under all conditions.

Influence of Temperature on Large Commutator Operation

F. T. Hague and G. W. Penney, Westinghouse Electric & Manufacturing Company.

The permissible temperature limits for a commutator are, unlike those of insulated windings, entirely determined by mechanical construction. Low temperature limits may lead to illogical designs, since large dissipating surfaces are required which may give higher stresses and larger expansion effects which may be more harmful than higher temperatures. A temperature limit is suggested.

Insulation Tests of Electrical Machinery

C. M. Gilt, Brooklyn Edison Company, and B. L. Barns, Canadian General Electric Company.

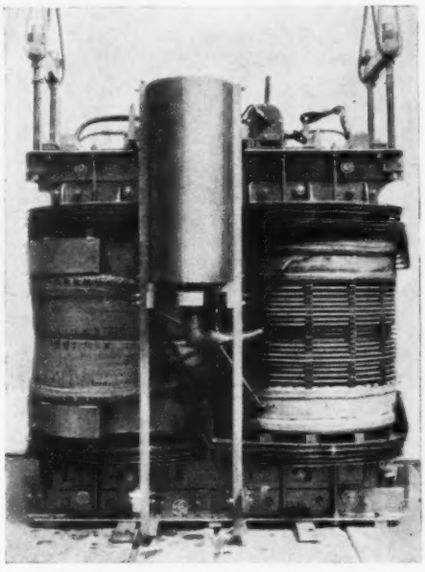
Specific recommendations for insulation testing prior to initial operation and during operating period of apparatus include, for the former, a voltage 85 per cent of factory test for one minute based on connected equipment receiving lowest factory test, and, for maintenance, a test to ground of 125 per cent rated voltage plus 500, and between phases, 175 per cent plus 500 volts.

cared Mr. Peek, and in the change back to inductive characteristics oscillations are set in the transformer windings which produce stresses as great as 100 times the normal stresses. These can be caused by lightning and switching surges even when it takes the transient 100 microseconds to reach its maximum value if the characteristics of the transformer are proper. Conditions are worse with long waves, Mr. Peek declared, because the oscillating voltage is maintained longer. He pointed out that heavier insulation was put on the line end of the windings originally to protect against the first impulse, but it is not possible to take care of the oscillatory impulses in the same way because there is no definite place at which they occur, so shields are used. Unless shunted with resistance, series inductance cannot protect transformers, and may even cause worse oscillation due to reflection.

In closing the discussion on his paper, Mr. Palueff pointed out that at the first instant a transient is received at a transformer the inductance acts as a pure capacitance, and therefore the voltage distribution throughout the windings of a transformer is not dependent on the coil connections. Because of the greater difference between the dimensions of interleaved pancake coils and the space between them and the tank than there is in other arrangements of coils it is more difficult to apply the shielding arrangement mentioned to the first type. Besides these answers to Mr. Peters' criticisms Mr. Palueff pointed out that the voltage to ground is the important factor rather than the turn-to-turn voltage stresses.

The paper by Messrs. Gilt and Barnes, recommending initial operating and maintenance test voltages, did not draw forth the discussion from operating engineers which was desired, but a number of manufacturers' representatives discussed the subject. In general, it appeared to be the consensus of opinion that an insulation test before operation should be made at a definite voltage less than the factory voltage, but whether it should be 85 per cent, as recommended, or some other value, was not evident from the discussion. The value of a maintenance testing voltage was evident, but the specific recommendations of the authors brought forth some differences of opinion and several speakers questioned whether it is within the province of the A.I.E.E. to specify this voltage, since it is more a question of what the insurance operators wish to place on their equipment.

S. L. Henderson of the Westinghouse company pointed out the importance of drying out apparatus before testing it if shipped in wet weather or installed under damp conditions. Since the end windings are the principal parts affected, space heaters are satisfactory for this purpose. He favored a one-half minute test instead of the one-minute test, recommended by the authors, for the installation tests before operation.



Shielded 20,000-kva., 132,000-volt transformer (Palueff)

J. R. Cady of the same company expressed the opinion that equipment placed in service before making installation tests should not be expected to withstand the initial test voltage and suggested that a voltage between the initial test and the maintenance test be recommended. On the other hand, new coils should take the initial test voltage, but combinations of old and new coils or second-hand machines should not. He objected to ungrounded testing circuits and expressed preference for grounding the mid-points if possible, by transformers if necessary.

F. E. H. Mowbray of the same company favored the recommended initial test voltage if the equipment is completely assembled, but not after any service. He differed with the maintenance test suggested because of the unequal stresses caused in different parts of the windings with a test to ground. Instead of two test conditions for maintenance he favored using 130 per cent rated voltage plus 500 volts for fifteen seconds, grounding two phases at the star, and testing the other phase to ground.

Since high-voltage test values obtained depend on dust and moisture, P. L. Alger of the General Electric Company maintained that equipment should be tested hot and cold to detect the effect of moisture. Cracks and holes can only be detected by high-voltage tests, he maintained. He also favored a single test to ground for maintenance tests at 130 per cent of normal voltage plus 500 volts.

Mr. Montsinger of the General Electric Company expressed the opinion that some value should be placed on initial test voltages, but questioned whether it should be 85 per cent of the factory test voltage. He did not consider that the maintenance test is so essential for transformers because it is possible to test and replace the oil frequently. He expressed the hope that operators who did not attend the session would express their opinions on the subject in writing.

James Burke recommended that all polyphase windings should be arranged so that phases can be conveniently separated.

In closing, Mr. Gilt expressed the opinion that equipment which will not withstand 50 per cent overvoltage is not safe, and that the Brooklyn Edison Company uses such overvoltage in making tests except on cables.

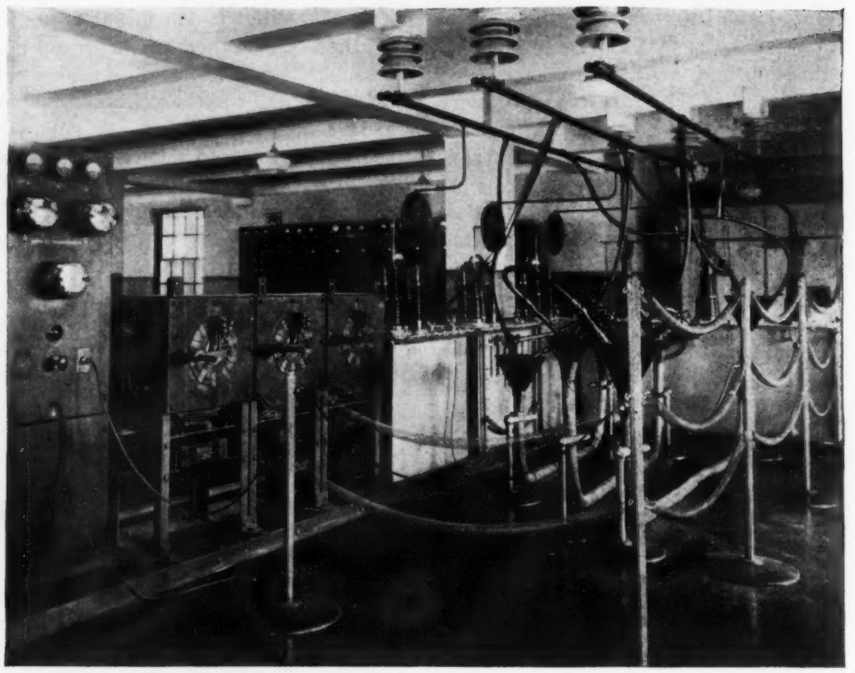
The paper by Messrs. Hague and Penney received enthusiastic commendation from several speakers, who maintained that commutator design had heretofore been more of an art than a science and that the information presented by the authors would enable placing commutator design on a more scientific basis.

Prof. W. L. Slichter was impressed by the statement of Mr. Barns that the A.I.E.E. standards force commutator construction which is not most desirable. Since the A.I.E.E. temperature requirements are less than European, this comment is very interesting, he declared, because it may bring the United States and Europe together on the standards.

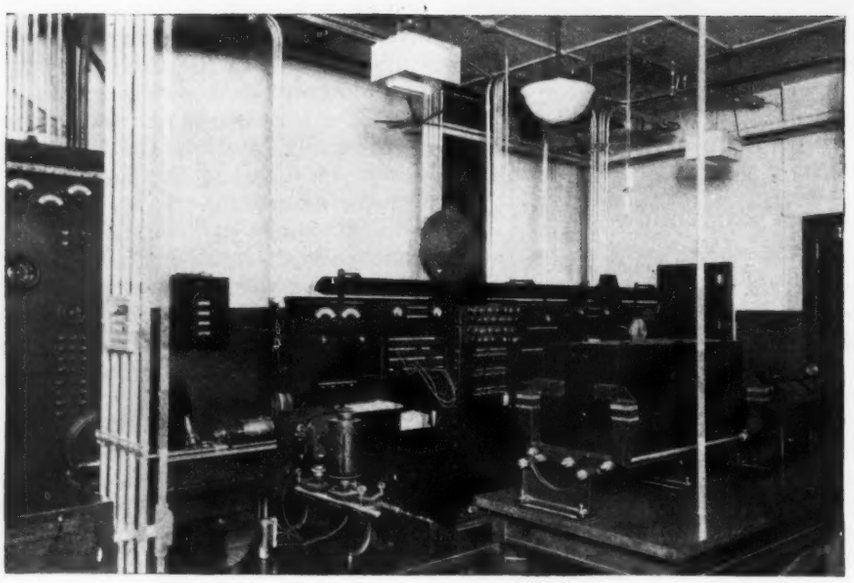
American limits to commutator temperature are higher than European, declared F. D. Newbury, but either or both countries may be wrong because there has not been a scientific basis heretofore for determining desirable commutator characteristics.

A. M. MacCutcheon of the Reliance Electric & Engineering Company expressed the opinion that the temperature limit of commutators should be reduced, because he has observed high current densities are handled without trouble when commutators are cool.

Points of Interest Visited by A. I. E. E. Delegates

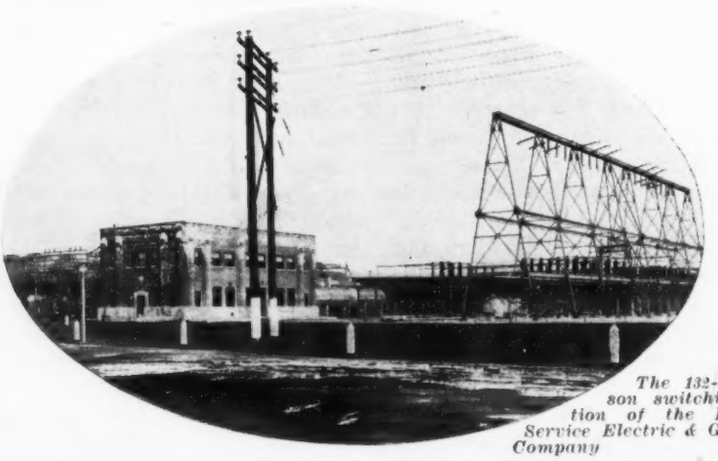


High-tension cable-testing facilities at the research laboratory of the Brooklyn Edison Company



WITH the most desirable and available sites for large generating stations in northeastern New Jersey limited to the large rivers or bays, the Public Service Electric & Gas Company has started what will eventually be a 132-kv. loop line which will afford two-way feed from its energy sources to high-tension step-down stations serving load-center distribution substations in the most populated and highly industrialized sections of Jersey. Hudson is one of the step-down substations.

Operating room for telephotographic service of the American Telephone & Telegraph Company



The 132-kv. Hudson switching station of the Public Service Electric & Gas Company

Cable Investigations

Progress in High-Tension Underground Cable Research

G. B. SHANKLIN and G. M. J. MACKAY, General Electric Company.

The "solid" type of paper-insulated, high-tension cable, the development of which is as yet incomplete, is given major consideration. Particular attention is devoted to void formation in the factory and in the field and investigatory methods are demonstrated. It is concluded that void formation under service conditions is inherent in paper-insulated "solid" cables and methods of reducing the size and duration of voids and increasing their pressure, thereby reducing the possibility of ionization deterioration, are evaluated. Oil reservoir feed at the joints is judged to be of value.

Losses in Armored, Single-Conductor Cables

O. R. SCHURIG, H. P. KUEHNI and F. W. BULLER, General Electric Company.

The losses occurring in single-conductor armored cables whose sheath and armor are bonded and grounded at more than one point are, besides the copper and dielectric losses, the circulating current losses in the sheath and armor, and additional iron losses in an armor of magnetic material. A loss-calculating procedure for determining the losses in single-conductor armored cables in a single-phase circuit or in a balanced three-phase circuit with equilateral spacing is presented. Copper armored cable is shown to have a lower total annual cost than steel-wire armored cable at load factors above 60 per cent, the latter having the advantage economically at lower load factors.

Reduction of Sheath Losses

HERMAN HALPERIN and K. W. MILLER, Commonwealth Edison Company.

The use of single-conductor, lead-covered cable for high-voltage, three-phase transmission lines results in sheath losses ranging from 25 to 300 per cent of the conductor losses for cables installed in separate ducts unless special methods for the reduction of losses are used. The authors developed a new scheme of bonding and a new bonding device. Laboratory tests and field work done on 132 miles of single conductor cable by Commonwealth Edison Company are mentioned. Investigations are reported on tests regarding the nature and extent of possible corrosion of sheath caused by alternating-current sheath voltages.

Ionization Studies in Paper-Insulated Cables—II

C. L. DAWES, H. H. REICHARD and P. H. HUMPHRIES, Harvard Engineering School.

The second report of the research conducted at Harvard Engineering School under auspices of the impregnated paper-insulated cable research committee. Included are a description of apparatus and method of impregnating test specimens having practically no occluded gases, development by analysis of ionization—loss curves, suggestions of power-loss-curve equation—constants as quality bases for cables, explanation of use of cable models for research, demonstration of triple nature of power-loss curves and of energy current, and character of capacitance curve.

Some Problems in High-Voltage Cable Development

E. W. DAVIS and W. N. EDDY, Simplex Wire & Cable Company.

Reliability of insulation quality determination is essential to satisfactory progress in high-voltage cable development and the most reliable test available is the overvoltage life test, although even this may not always give a true indication. Ionization tests are usually in fair agreement with overvoltage determinations. Air resistance of the paper used has a material influence on insulation quality of completed cable. Air content of the insulation might increase the tendency to ionization because of the resulting decrease in void pressure. Ionization might be decreased by the presence of moisture in the insulation because of the resulting more complete void distribution and consequent smaller size of each void.

FOLLOWING the presentation of the several papers at the cable session, it was pointed out by M. T. Crawford that certain experiences of the Puget Sound Power & Light Company indicated that with cables employing oil-filled reservoirs the pumping action sometimes assumes such serious proportions that it is necessary to tap and bleed the cable of compound in order to permit full load operation. The increase in pressure sometimes leads to the mechanical breakdown of the lead sheath. The desirability of supplying a stronger sleeve or expansion joints when fully impregnated cables are used was suggested.

F. A. Brownell referred to the experience on cable sections which had been rejected because of wrinkles in the paper insulation. G. W. Davis added that certain high-voltage cables tested to destruction had shown no failures due to torn paper in the dielectric and developed but a single failure due to wrinkled insulation.

Theoretical and field investigations with oil-filled joints led H. Halperin to express doubt regarding the value of reservoir joints for maintenance of impregnation in solid cable. Mr. Halperin quoted the results of tests which indicated that oil migrates but a few feet on either side of the reservoir in most instances, and so could only be considered of little use in closing the voids formed upon the cooling of the cable. Mr. Halperin stated that under certain conditions a static equivalent to 35 lb. per square inch had been formed in a cable at the bottom of a grade and that migration of the compound had taken place and the cable sheath had ruptured. Even in this instance it was felt that the compound traveled too slowly to be practically worth while, the resistance to flow being entirely too great. It was also concluded that in many cases neither operating temperature nor temperature range in solid cables had a major influence.

W. B. Kouwenhoven has used wound paper samples in his investigation of dielectric values and suggested that they were preferable to flat samples.

The opinion that ionization phenomena are not simple but could be more accurately represented by curves whose slopes vary as the electrostatic changes occur at varying distances from the center of the cable due to variation in void space was expressed by J. F. Peterson. It has been his experience that for voltages between 600 and 13,000 or 15,000 a certain amount of air is desirable and may be included without involving detrimental voids. Up to 6 or 7 per cent of air was judged to be permissible.

R. W. Atkinson said that methods of measuring void space were so difficult and uncertain of yielding comparable results that determinations by several investigators could not be compared without knowing the methods employed for measuring the void space. He discerned a tendency toward the oil-filled cable with stop joints and to the application of oil-filled cable which is a compromise between the solid type and the strictly oil-filled type. The shielded type of cable was considered to have cumulatively greater importance.

J. B. Whitehead said that laboratory tests show that both air and moisture can cause a rising power factor curve even in well-impregnated cables and stated that a falling power factor can be obtained at high temperatures and for well-impregnated cables. At the beginning of gaseous ionization there is a considerable increase in pressure in the gas space which may not be attributed to the increase in temperature caused by the ionization of the gas.

Developments with the oil-filled cables were commented upon by E. S. Lee, who credited them largely to early laboratory work in which compound-filled cables were tested at elevated temperatures in endurance tests and found to be thousands of hours in life at 85 deg. C., while they had but five to 165 hours life at 25 deg. C.

In closing the discussion Mr. MacKay conceded that reinforcement of the sheath by special alloys used at the joints was desirable and that wrinkles may act as collectors of gases at either high or low pressure and lead to ionization.

Mr. Dawes in closing stated that power factor sometimes decreased with increases of voltage at higher temperatures.

H. R. Searing stated that sheath deterioration was not always due to the sheath potential, but might be the result of improper fireproofing or similar factors and stated that he had followed the method of cross-bonding mentioned by Mr. Halperin for several years. The triplex oil-filled cable was assumed to be preferable to single-conductor cables from a regulation standpoint. Savings of 3 or 4 kw. per mile may be made by proper bonding of the sheath.

B. S. Creager stated that under fault conditions the total sheath voltage was a combination of the induced voltage and the return current voltage and might be equal to 300 volts in some instances.

Instruments and Measurements

THE many possible applications for the magnetic analysis of materials offered the major source of comment at this session on Friday morning.

An important possibility, not mentioned by Mr. Sanford, was pointed out in the discussion submitted by B. M. Smith. This had to do with the determination of the chemical composition of magnetic materials, with particular reference to the carbon content of iron or steel. Such analyses may be made by reference to conditions of magnetic saturation or to the characteristics of unsymmetrical hysteresis loops by means of the carbometer.

132-Kv. Shielded Potentiometer for Determining Accuracy of Potential Transformers

C. T. Weller, General Electric Company.

The application of the potentiometer principle to the determination of the ratio and phase angle accuracy of potential transformers has heretofore been limited in unshielded form to about 66 kv. and in shielded form to about 33 kw. The use of 100,000-ohm resistor units, fractional and accessory, resistors and shielding transformers and other refinements permitted the design of a shielded 132-kw. potentiometer.

Telemetering

C. H. Linder, C. E. Stewart, H. B. Rex and A. S. Fitzgerald, General Electric Company.

Telemetric measurements may be made by transmitted readings of indicating, recording, demand and integrating devices. Channels for use with this form of metering may be multi-conductor cables, wire construction and transmission lines. Several successful types are inverse current, selsyn, rectified current, varying-frequency impulse and vacuum tube.

Study of Noises in Electrical Apparatus

T. Spooner and J. P. Foltz, Westinghouse Electric & Manufacturing Company.

Two resonance types of simple portable sound analyzer which permit the determination of the amplitude and frequency of the components of complex sounds arising from electrical apparatus have been developed. Applications vary from noise studies in gears, motors and generators to induction regulators, loud speakers and vacuum sweepers.

Totalizing of Electric System Loads

P. M. Lincoln, Cornell University.

The importance of measuring an electric system load at any distance from that load is emphasized in connection with the exposition of a system using thermal wattmeters in conjunction with thermocouples. The time response of such devices is discussed and temperatures obtained outlined, as are the characteristics of circuits for transmitting the thermal emf. from the load to the point of measurement. It is said that while actual experience with this new totalizing system has been limited to but three years, nothing has developed to lead to the anticipation of any difficulty. Direct-current leakage into the transmitting wires is credited with being the only thing which must be guarded against and proper installational precautions minimize this influence.

A Precision Regulator for Alternating Voltage

H. M. Stoller and J. R. Power, Bell Telephone Laboratories, Inc.

A regulator which will maintain its output voltage constant to within 0.03 per cent over an input voltage range of 10 per cent and a load range of from zero to full load has been recently developed. A small transformer is inserted in one of the lines which boosts or bucks the impressed voltage by the required amount. The transformer is controlled by a vacuum tube circuit acting through an inductance bridge.

Electrical Aids to Navigation

Robert H. Marriott, Brooklyn, N. Y.

Electrical and magnetic aids to navigation by water and air are outlined, the principal ones being the earth inductor compass, the radio compass, the radio beacon, submarine signals, depth finder, distance finders, channel marking signals, fog-penetrating lights and height indicators for aircraft.

Use of Oscillograph for Non-Electrical Quantities

S. D. Miner and W. B. Batten, Westinghouse Electric & Manufacturing Company.

Electromagnetic oscillographs may be used for obtaining recorded measurements of non-electrical quantities, such as travel of machine parts, speed, vibration, timing, stresses and pressures. The problems of application involve the translation of mechanical phenomena into electrical quantities which are proportional. The element of the instrument is a low inertia galvanometer.

Magnetic Analysis

RAYMOND L. SANFORD, U. S. Bureau of Standards.

A development of the subject of magnetic analysis to indicate its present status and to suggest lines along which further investigation may be profitably directed. It is concluded that to be of maximum value fundamental investigations must be planned and carried out not only from the standpoint of the magnetic phenomena but also from the point of view of the metallurgical principles involved.

A New High Accuracy Current Transformer

M. S. WILSON, General Electric Company.

Both ratio and phase angle errors between light and full load are reduced for the various conditions of burden, frequency and secondary current by a new method of winding current transformers in which the secondary turns inclose a section of the magnetic circuit and a short-circuited band encircles the same section. Overload characteristics are not injured by the use of this method of reducing transformer errors.

Electrical Instruments Used in Measurement of Flow

W. H. PRATT, General Electric Company.

Fundamentally, fluid measurement is a problem in hydromechanics and electrical apparatus used is supplementary. Instruments have been classified according to measurements of unconfined flow and measurements in confined channels. The theoretical considerations and limitations involved in the several types of instrument are described.

W. B. Kouwenhoven referred to an incremental permeability method whereby a d.c. or a.c. field may be superimposed on a constant d.c. magnetizing field to indicate magnetic characteristics with presumably greater accuracy.

The discovery of an intimate relationship between magnetic analysis and all unknown mechanical properties of steel was anticipated by A. DeForest, who pointed out that magnetic methods are more fundamental and reliable than mechanical and that apparent inconsistencies are often due to crudities in the latter class of investigations.

The discussion prepared by M. A. Rusher referred to the possibilities realizable in the analysis of the vibration of magnetic materials, or even non-magnetic ones to which magnetic points may be attached, and to other unusual applications. The use of a steel diaphragm whose vibrations may be analyzed permits the pulsations in hydro station draft tubes to be investigated.

In using thermal wattmeters the resistance of the potentiometer, line and thermocouples should be considered, J. B. Brooks suggested. He added that the resistance of the galvanometer coil should equal the resistance of the source for accurate results. An indicating type meter with resistance adjuster may be used instead of a galvanometer.

S. C. Jacoby stated that frequency telemetering was used by his company and had many advantages. It gives warning of trouble instantly, gives smoother operation, allows of checking switching operations, enables location of source of disturbance.

A brief history of telemetering was given by C. Lichtenberg, who added that there were many more types than those presented, these having been offered to indicate to engineers what might be expected.

I. A. McKenzie gave his experience with thermal meters, stating that they were highly accurate.

Bela Gati, in discussing thermal metering, stated that he had been able to obtain much quicker response than that described in Professor Lincoln's paper.

Communication Developments

THE washing of insulating materials used in telephone practice has led to notable economies, said W. M. Fondiller, and enables the telephone company to save more than $1,500,000 per year.

In response to an inquiry by Bela Gati regarding the experience the telephone laboratory has had with tropical installations E. J. Murphy replied that, while no actual tests have been made, investigations made with relative humidity of 85 per cent and over would simulate tropical conditions.

R. V. Ross, in commenting on the insulation tests, raised the question as to how the water content of an insulating material was determined, adding that according to his experience a dried material shows a strong affinity for moisture and that therefore difficulty may be anticipated in keeping it dry. The complexity of the problem was conceded by Mr. Wood.

Influence of Moisture and Electrolytic Material Upon Textiles as Insulators

R. R. WILLIAMS and E. J. MURPHY, Bell Telephone Laboratories, Inc.

Upon the contention that the quantity and mode of distribution of water in all insulating materials largely determine their relative excellence, the authors investigated the dielectric properties of a number of textiles. Fibers have been classified according to their electric behavior, such differences being due to differences in the space patterns according to which water is distributed within the fibers.

Vector Presentation of Broad-Band Wave Filters

R. F. MALLINA and O. KNACKMUSS, Victor Talking Machine Company.

The function of a broad-band wave filter of the iterative ladder type in and out of the attenuation band is vectorily developed showing the relationship between the mid-series and mid-shunt structures. Equations for such filters are likewise presented in a further endeavor to simplify the physical significance of this equipment used so extensively in radio, acoustical and mechanical engineering.

Purified Textile Insulation

H. H. GLENN and E. B. WOOD, Bell Telephone Laboratories, Inc.

The improvements in dielectric properties and reduced electrolysis of the silk and cotton used in telephone central office cabling obtained by washing and impregnating are apparently substantially additive. It is concluded that the removal of water-soluble salts which are present in both silk and cotton results in decided improvement in their insulation properties and reduces the sensitivity to change of the a.c. characteristics.

Uses of Radio as an Aid to Air Navigation

J. H. DELLINGER, U. S. Bureau of Standards.

The possibilities of using radio for guiding airplanes along fixed airways during fog or other conditions of low visibility lie largely within the application of a directive radio beacon system which, with suitable receiving equipment, gives simple and direct visual indications of plane location.

Induction Motors

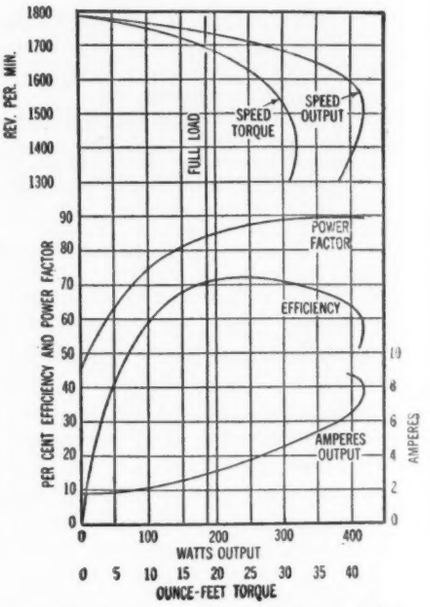
THE potentialities and limitations of the condenser motor, the imposition of unduly rigorous N.E.L.A. starting current rules and their effect upon line-start induction motor performance were the chief sources of discussion at the motor session on Thursday morning.

The considerations leading to the development of the condenser motor were seen by P. L. Alger as having been dictated by several groups—utilities desiring better power factor and lower starting currents, refrigerator manufacturers desiring higher starting torque, the housewife wishing less noise and radio manufacturers seeking less interference. The cost of condenser motors was foreseen by Mr. Alger as the only deterrent factor in the development of this type of equipment for single-phase use.

In discussing the paper of Professor Bailey, C. R. Boothby pointed out that the use of an equal weight of copper in each phase was less desirable than an increase in the weight in the main phase and a reduction of that in the capacitor phase, since more economical construction could be obtained by such a design. This was likewise the contention of H. C. Specht.

That a higher starting current for condenser motors sometimes prevented their installation in certain industrial plants was the contention of H. C. Louis, who also pointed out that sometimes the condenser failed to stand up in prolonged service.

A. Nyman endeavored to clear up the difficulties regarding condenser requirements and pointed out that these units might be either of the paper or electrolytic type; the life of the former, as with cable, depending upon the voltage and varying as an exponential equivalent of the voltage. The electrolytic type has the advantage of large capacity, the disadvantage of high losses and is, in the opinion of Mr. Nyman, not generally applicable for capacitor motors. It was Mr. Nyman's contention that the life of a condenser suitable for such use should be selected with full consideration for the reduced life caused by the stresses during the starting period, which should be subtracted from the estimated life at the operat-



Performance characteristics of ¼-hp. capacitor motor (Morrill)

The Condenser Motor

BENJAMIN F. BAILEY, University of Michigan.

The importance of varying the capacitance from a large amount at starting to a gradually lessened amount for running conditions is pointed out. If it were practicable to adjust the capacitance to exactly the proper value corresponding to each value of load and speed the motor would operate virtually as a two-phase motor, the combination of the condenser and line operating as a phase changer to convert single-phase supply into a two-phase supply. The excellent reversing torque characteristics of condenser motors are also of importance.

No-Load Induction Motor Core Losses

T. SPOONER and C. W. KINCAID, Westinghouse Electric & Manufacturing Company.

A detailed method of calculating the no-load core losses of induction motors whereby each loss component is estimated separately is offered which is conceded to be rather tedious and complicated as compared with the older empirical methods, but which it is said may be greatly simplified and shortened by proper scheduling. A discussion of extra losses due to imperfection in workmanship is included. As an indication of the reliability of the method suggested, calculated and test results for a few commercial machines are given. Losses have been segregated according to fundamental frequency losses, and also stator core and stator tooth losses and pulsation losses, including those of surface, tooth pulsation and copper eddy and illegitimate classes.

Fundamental Theory of the Capacitor Motor

H. C. SPECHT, Westinghouse Electric & Manufacturing Company.

An exposition of the fundamental theory of the motor and capacitor developed by both algebraic and graphical methods. Variables in the design of a complete capacitor motor unit for any desired performance are discussed and examples of unbalanced phases and performance given. It is concluded that the motor has good performance in respect to power factor, efficiency, starting current and torques; is simple in construction; is applicable to a broader field than any other type of single-phase motor; requires more space, and costs more than any other single-phase type. The latter is recognized as the only factor which may react against its present-day use.

Line Start Induction Motors

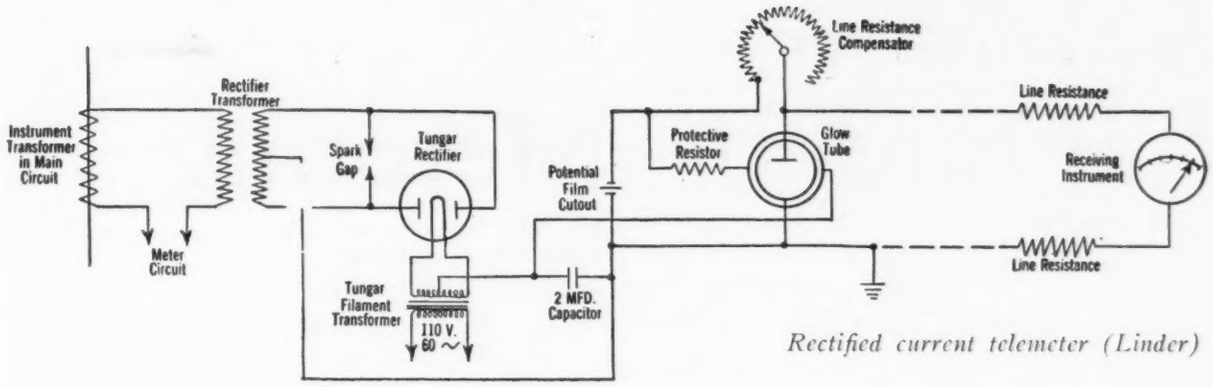
C. J. KOCH, General Electric Company.

The starting and running characteristics of the common types of polyphase induction motors suitable for starting at full voltage are considered, as is the influence of permissible starting current values upon these characteristics. It is concluded that the line start motor has necessarily a lower maximum running torque than the standard squirrel-cage motor; it is not advisable to build line-start motors for general purpose use with a starting current below the equivalent of 6 amp. per horsepower on 440-volt, 60-cycle circuits; motors in sizes above 30 hp. (N.E.L.A. rules) are not suitable for general purpose applications; two types are available.

Revolving Field Theory of the Capacitor Motor

WAYNE J. MORRILL, General Electric Company.

In order to evaluate the principal factors affecting practical capacitor motor design the general equations for an unbalanced two-phase motor are first derived in connection with starting and running performance. Evidence of the validity of the revolving field theory is given in the form of curves comparing test results with calculations. The author concludes that the capacitor design is potentially suitable for a very high quality motor since it has excellent performance characteristics.



Rectified current telemeter (Linder)

ing voltage, a conservative rating being desirable if satisfactory results are to be obtained.

T. M. Linville pointed out that capacitor motors are not inherently reversible in characteristics, the reversing property being predominantly a function of the reactance employed in series with the capacitor.

The capacitor motor has lower pull-out torque than a two-phase motor, said H. C. Specht, and for several other reasons should be used for single-phase and not for two-phase substitution. The failure of condensers has, in his opinion, been due to results of motor phenomena which involve the rise of voltage at starting to a point which may be highly detrimental. The increased cost of manufacture of the condenser motor was seen as depending largely upon the required starting torque and power-factor-correction-characteristics of the equipment. No size limitations other than those involved in the capacity of the supply circuits were recognized by the speaker, who added that when polyphase circuits are available the capacitor motor is not to be considered desirable.

P. H. Rutherford felt that a considerably increased demand for the commercial use of capacitor motors would lead to a reduction in cost, since the difference between the capacitor motor and the customary induction motor is not great.

P. S. Creager expressed the intention that the power companies are too severe in their concept of desirable motor characteristics and pointed out that under many circumstances a starting current 30 to 50 per cent higher than allowed for induction motors would not be disastrous. Professor Creager foresaw radio interference and quietness as the principal elements in overcoming the objection of higher expense.

The rules of the National Electric Light Association which limit the starting current for line-start induction motors were criticised by a number of those who discussed the paper of C. J. Koch, including F. E. Harrell, whose contention was that the limiting values impaired the satisfactory performance of the motors. C. W. Kincaid felt that these rules limit the design unnecessarily and do not permit a realization of the possibilities of this type of motor. A. M. MacCutcheon pointed out that standard induction motors can be thrown on the line without unfortunate consequences and that in one instance a 2,400-hp. motor is known to be thrown directly on the line without ensuing difficulties. Mr. McCutcheon added that there has been more trouble in the last ten years with compensators than with squirrel cage motors. It was also suggested that motors which are started but once or twice during a week should have a different classification and set of rules than those started frequently during periods of the day when unsatisfactory conditions would be concomitant. C. A. Adams also sought an upward revision of N.E.L.A. starting current allowances and pointed out that in one instance a 350-kva. transformer whose momentary load was limited by agreement to 500 kva. had been used for 700 or 800 kva. without any complaint about flickering lights. C. W. Franklin stated that the type and arrangement of distribution facilities affected the permissible conditions and that in the territory served by his company a 1,000-hp. motor was permitted to be started directly across the line in one instance, but that a 7 to 10-hp. motor without compensators could not be used under different conditions because of the difficulties that other customers had with flickering lights.

*A Call for Electrical Statesmanship**

By T. T. Whitney

Vice-President Stone & Webster and Blodget, Inc., Boston

"WHAT has been going on in New England in the way of acquisition of companies for one purpose or another has been warfare, and the kind of warfare that should not exist in this enlightened age, when it is the predominant opinion that war should stop.

"If there is anything that should be worked out by negotiation with the boards of directors responsible to the stockholders, and not by the ruthless tactics of putting stockholders in a panic by moving stocks up and down so that control is acquired by stock-jobbing methods, it is this situation in New England. We should all look at this matter sanely. It requires talents of statesmanship rather than stock-jobbing. What we all want is the best solution for New England so that we can have cheap power and cheap rates.

"It is proper that there should be a knitting together of interests and companies so that sound progress may be made with a fair trade for all concerned. Public opinion in the state of Massachusetts has come to the breaking point in putting up longer with the kind of tactics that have been prevailing."

**Excerpts from speech before the New England Public Relations Section of the N.E.L.A.*

New Facilities for

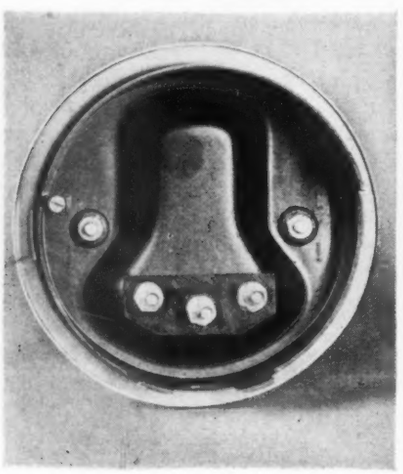
Outdoor Metering

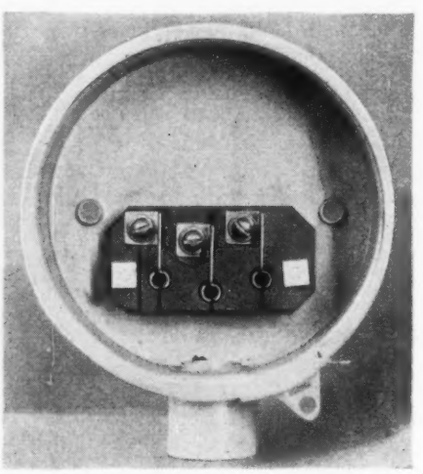
Meter with separable sub-base now available for outdoor installation. Cost of reading is large factor in determining economy of use of new design. Consideration of testing introduces argument

LOCATION of meters outside rather than inside detached dwellings, to avoid "missed readings," has for some time been the subject of experiment and development. The ability to secure the reading of every meter on the first call at the end of each billing period is something devoutly to be desired by every electricity supply company. Missed readings are not only a distinct and considerable item of expense by reason of added costs for second, third and fourth calls but they are often the cause of apparently high bills which inspire complaints and injure customer relations. The selling of electricity, like every other commercial activity, is based upon the proposition that bills will be computed, rendered and paid at definite intervals and anything that interferes with any part of this routine is undesirable. The first two parts are functions of the electric company and, naturally, it seeks to discharge them in as nearly perfect a manner as is possible. A meter that can always be read at the time it should be read is therefore one consideration in the sale of electricity.

The latest contribution to this need is the outdoor meter recently shown herewith and developed by the Westinghouse Electric & Manufacturing Company. This meter has been the subject of discussion at a number of industry meetings and among meter men since its announcement a few months ago. Like all new things, it has met with both enthusiasm and disapproval. In order to give its readers a disinterested picture of the situation the ELECTRICAL WORLD secured an interview with H. P. Sparkes, who, with the Westinghouse meter engineers, developed the device, and also some other opinion, not wholly favorable.

So far, there has been developed only one method of installation, but others are on the way. Probably an early one to be announced will be a sub-base with diametrically opposite conduit couplings so that the meter may be installed at any point that is desired in the conduit riser on the side of the house. Another development will probably be a meter and switch panel box for multiple installations, as in an apartment house, in which the sub-bases will be built into the panel and a meter installation will be simply a matter of plugging the meter in.





Figs. 1, 2 and 3—Elements of new outdoor meter

The meter consists of a standard type OB made in two- and three-wire designs for 5-, 10- or 15-amp. It is equipped with a separable sub-base, about 1¼ in. deep, which contains a terminal block to which the wires are brought through a conduit coupling. On the back of the meter are three connection pins which engage in the self-aligning spring sleeves in the terminal block when the meter is placed in the sub-base. A weatherproof joint is afforded between the meter cover and the sub-base by flanges on the two which are held together by a slotted and hinged ring, which may be locked with the usual type of meter seal.

The glass cover is held to the back of the meter by a bayonet joint and is locked in place by the screw, which may also be sealed. The meter is compensated for the range of temperatures encountered in outdoor installations. Adequate protection is made against condensation of moisture inside the meter case, and the sub-base is provided with a breather hole through the cover-holding screw in the back of the case and a small drainage wick in the sub-base.

The sub-base is fastened to the side of the house by two screws after the threadless weatherproof inlet fitting is screwed into the conduit coupling. The fitting is then clamped to the top of the conduit riser. The service wires enter through the composition bushing plate of the fitting and both are carried up into the meter sub-base. One conductor is broken for connection to the two terminals which engage the current coil studs of the meter and the other is looped onto the potential terminal. Consequently there are four wires in the conduit coupling, two in and two out, as is customary in all meter terminal boxes.

When the meter is removed the sub-base is closed with a flat cover, which is held and sealed by the slotted ring. This cover protects the terminal block from the weather and prevents unauthorized use of energy without a meter.

From the illustrations and supplementary descriptions it may be observed that the meter is ahead of, and is not protected by, the service entrance switch and fuses. A few years ago this condition would not have been allowed, but experience has shown that the meter is no worse off ahead of than behind the fuses. So far as meter life and performance are concerned, there is nothing to choose between the two locations.

The principal reasons for developing the meter are related in some way to the job of reading meters. Other advantages are claimed for the design, some of which are evident, others debatable.

On one major central-station system it is stated that one in every six readings is missed on the first call. The ratio will not hold for all central stations, it is true, but,

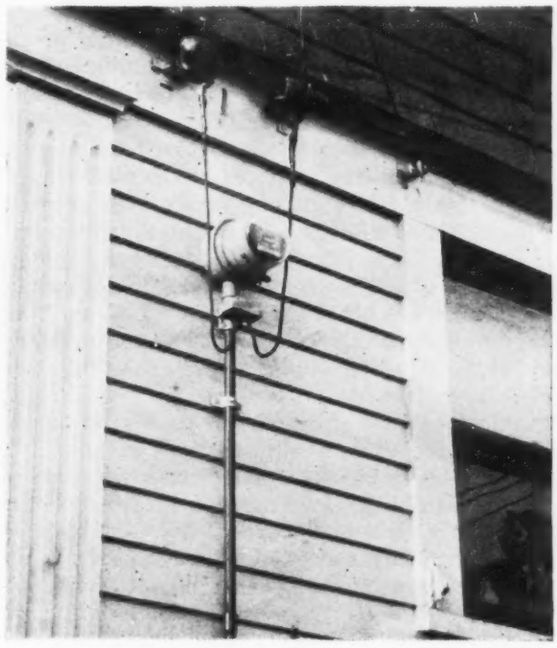


Fig. 4—Meter installed with service drops

on the other hand, there may be some that will set it even higher. It is certainly true that any central station that numbers among its customers many households in which both husband and wife work or that has any great amount of seasonal resort business will find its meter reading costs appreciably increased by its inability to get readings on the first call. Even if customers co-operate to the extent of specifying a time when they will be home or leave keys with the company so the reader may enter the premises, there remains the fact that both of these conditions require special attention, which always means special expense.

Let us assume that a company has 30,000 services to detached single and double houses and to terraced flats. If only one in ten readings—not one in six—is missed on the first call and all "misses" are caught on the second, there will be 5,000 extra readings each month. Suppose it costs 7 cents for a second trip to read a meter. Then there is an added expense every month of $210. To gain entrance to a house, walk to the meter and come out will take any reader at least one minute on the average. If the meter were outside this minute would be saved. One minute on each of 30,000 meters is 500 hours per month. This time at 75 cents per hour amounts to $375. In "misses" and slower reading speed the meters in the houses then have a total excess cost over outside meters of $585 per month for meter readers' time alone. Add to this the clerical expense entailed by missed readings and there will be at the very least a figure of $700 per month, or $8,400 per year. Capitalized at 6 per cent, $140,000, or $4 per meter, may profitably be spent to improve meter reading conditions.

On new houses it is estimated that the outdoor meter can be placed at an additional cost of $1.25 over the inside installation. What it would cost to change existing installations is any one's guess; it might be little or much, depending on local conditions. At any rate, and whether or not one agrees with the assumptions of costs made here, it can safely be said that an analysis of the extra expense caused by missed readings in any central station will result in a figure which, when capitalized, will be of respectable proportions.

Quite aside from the foregoing apparently easily estimated figures, there are other direct money losses on account of missed readings. Among these are the cost of high-bill complaints caused by longer intervals between readings, loss of use of money on delayed bills, and possible losses due to inability to make final readings. Missed readings are always an annoyance to the customer as well as to the company. The companies in favor of this new meter maintain that it will improve customer relations for this reason and also because the customer will not be bothered by the meter reader at any time.

Other Advantages Claimed

Further claims made for this new meter by proponents are:

1. Comparatively expensive service entrance and meter boxes will be eliminated and an adequate, but cheaper, box containing, for a two-wire service, only a single blade switch and one fuse may be used.
2. Since the meter is outdoors and in plain sight, the possibilities of current theft are reduced.
3. Meter removal costs are higher than meter installation costs because removals require a larger number of calls, the customer being less anxious about removal than installation. A service may be cut off by simply pulling out the meter and sealing the plate over the sub-base. For seasonal business the meter is valuable because it may be removed readily and the final reading obtained. During the semi-annual moving periods in May and October the work of installing and removing meters may be much accelerated by the outdoor design.

Objections Raised

One of the incidental advantages claimed in the foregoing is that with the new meter the customer will not be bothered by a visit from the meter reader. In view of the possibility of utilizing the meter reader as a good-will agent of the electric service company this claim is not altogether undebatable. Some companies already are instructing meter readers to inquire as to the use and condition of appliances in order to unearth sales prospects and to report on devices not in use for any reason. In many cases, also, the meter reader is the only continuous link of human contact between the customer and the company, and it is questionable whether that link should be destroyed or maintained. Some central-station men say that it is possible to carry efficiency and economy to extremes in matters that include human relations.

More debatable matter is encountered when testing the new meters is considered. Different testing schemes are contemplated. One is to set up a gang-testing board in a temporary location in a district and send out a truck

to gather up a load of meters and bring them into the testing room, returning each meter to its proper location after test. While a meter is removed for test a jumper block would be inserted in the sub-base to maintain service. Another method would substitute a tested meter for the old one. Both of these manners of testing are open to the objection that the meter is not tested in place and there is no way of knowing positively the accuracy of the meter installed.

Investigation has shown that the most common cause of meter inaccuracy is handling, and it has been generally accepted that an actual test of a meter *in situ* is the only positive index of its accuracy. The second method has the added drawback that every test requires a change in the meter record of a customer.

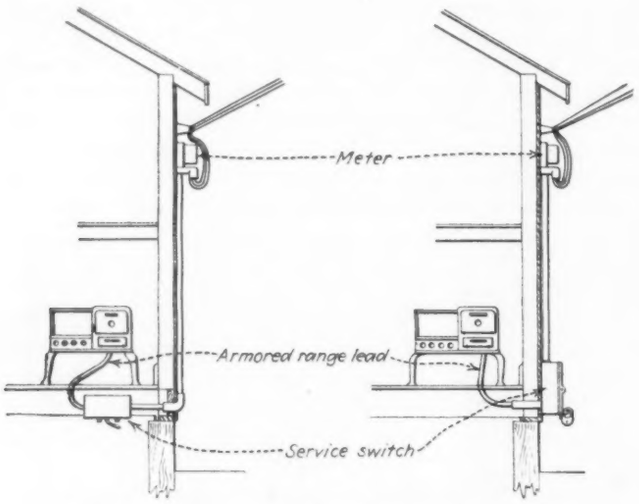


Fig. 5—Suggested adaptations of the outdoor meter to range installations

Other test methods under development or already devised make use of a test box installed in the conduit riser on the side of the house or of an intermediate block with leads attached to be temporarily inserted between the meter and the sub-base. These facilities permit tests in place and may not be objected to on the same score as the two first described, but it is open to question whether a meter tester is capable of particularly good work while testing outdoors in zero weather. Therefore it is apparent that so far as testing of the outdoor meter is concerned there are both pros and cons to be considered. Possibly companies which adopt the new meter will find the difficulties easy to solve.

An interesting possible application of the new meter for economy in range installations is illustrated. It has been suggested that ranges be furnished with permanently attached BX or other approved conductor leads of sufficient length that can be run directly to a switch box installed inside or outside the house. The customer might bear only the expense of this box plus the labor charge of running the range lead to it. Such an installation would be for a two-meter service, but if it were desired to use only one meter it would be a simple matter to connect the lighting circuits to the range service by tapping in at the nearest available point and back feeding to the distribution center.

That there are solid advantages in the use of the outdoor meter is attested by the fact that already at least four central stations are definitely committed to it in greater or less degree and that many others are giving it serious consideration. These companies are all located in the East Central group of states, where, since it was brought out in October, the meter is better known than in other parts of the country. Utility executives and meter men will watch the experiences of these companies with much interest and by analyzing these experiences will be able to reach their own conclusions as to the acceptability of this rather radical departure in the meter art.

Estimating Savings Due to Interconnection

IN A recent survey of regional power supply possibilities the method of estimating savings due to interconnected operation was set forth as follows:

It was assumed that the aggregate system of companies tied together by transmission lines would be operated by a central load dispatching office in such a way as to deliver the total amount of power required at minimum cost, taking into account the cost of power purchased from outside sources and the cost of generation on each of the co-operating systems. In general, a differential in favor of purchasing rather than generating power would have to exist to warrant the reception of energy in block form from outside vendors.

The method of estimating the cost of operation under the interconnection plan was first to build up typical load curves representative of the various load conditions of each of participating utilities and also for the zone as a whole. Then from a consideration of the load requirements and the relative efficiencies of the various generating units in each station followed the determination of which generating units should carry the loads from hour to hour. In fitting the generating units to the load, care was taken to utilize the hydro-electric stations to the maximum practicable capacity on peak loads and also to keep sufficient load on the hydro plants at night to prevent wastage of water over dams. In order to make provision for units being out of service part of the time, the rule was established in fitting generating units to the load of limiting the output relied upon in normal operation to 85 per cent of the rating of each steam generating unit and to 95 per cent of each hydro unit.

After the generating units were fitted under the zone load curves, the resultant load curve was determined for each generating station. From the consideration of these load curves and of the curves of local power consumption it was then possible to determine the amount of power exported from or imported into each district, with resultant transmission losses, which must also be supplied by the combined system.

From the load curves and records of operating cost of each generating station estimates were made of the total operating cost within the zone of interconnection, after making due allowance for the effect on operating costs of the change in load factor at individual stations resulting from the transfer of load from one station to the other. To allow for commercial variations an estimate was made of the difference in cost of operation of the constituent groups individually under a similar ideal régime as compared with the actual cost of operating as shown by their records. The difference thus shown was deducted from the apparent saving resulting from ideal operation of the complete interconnected system in order to arrive at the possible savings to be reaped under commercial operating conditions.

Electric Water Heating
in Europe

Large consumptions of off-peak energy for domestic water heating effect marked improvements in system load factors. American-made heaters best adapted to use in this country

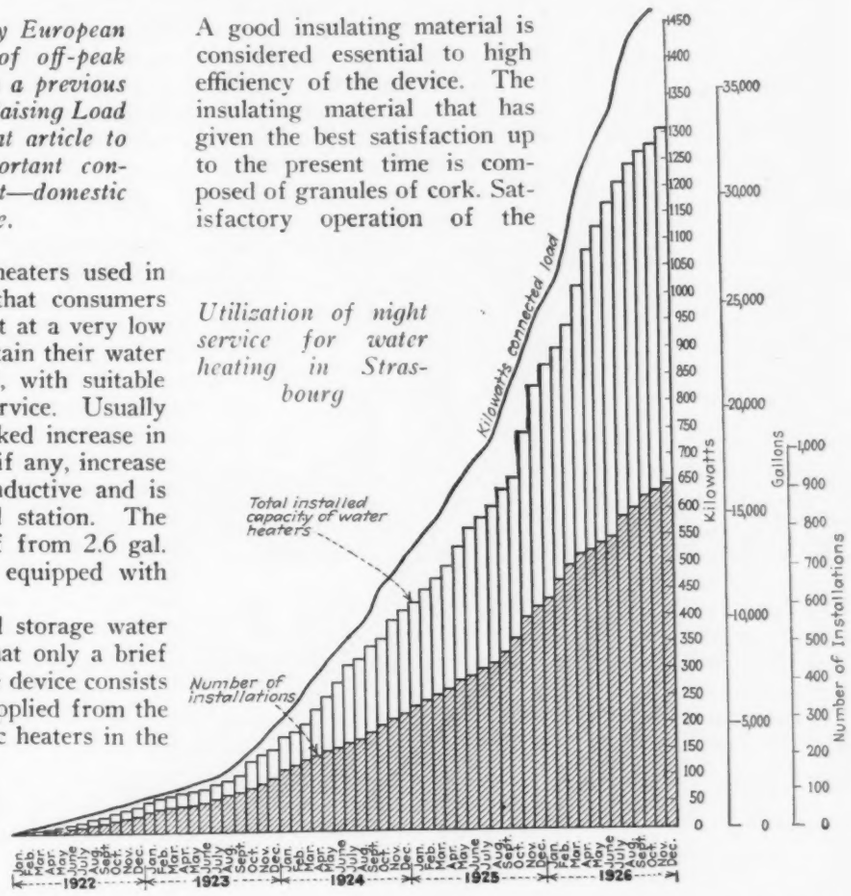
By J. C. LANGDELL
Allied Power & Light Corporation, Jackson, Mich.

The methods and practices of many European electric utilities in the development of off-peak load were treated in a general way in a previous article, entitled "Foreign Progress in Raising Load Factor." There was not space in that article to discuss in any detail the most important contributor to load factor improvement—domestic water heating—which is discussed here.

IN MOST cases the domestic water heaters used in Europe are of the storage type so that consumers may purchase current during the night at a very low rate. They are constructed so as to maintain their water temperature over very long periods and, with suitable capacity installed, have given excellent service. Usually their installation has not resulted in marked increase in distribution fixed charges and very little, if any, increase in plant investment. The load is non-inductive and is an ideal off-peak burden for the central station. The heaters are manufactured in capacities of from 2.6 gal. to 260 and in practically all cases are equipped with thermostat and time switch.

The principle of the electrically heated storage water heater in use abroad is so well known that only a brief summary is necessary for our study. The device consists of a zinc tank, well heat-insulated and supplied from the cold water system, an assembly of electric heaters in the base with current flowing when the temperature is less than 90 deg. C. and cut off when this temperature is reached. By means of a time switch the current is cut off during the day.

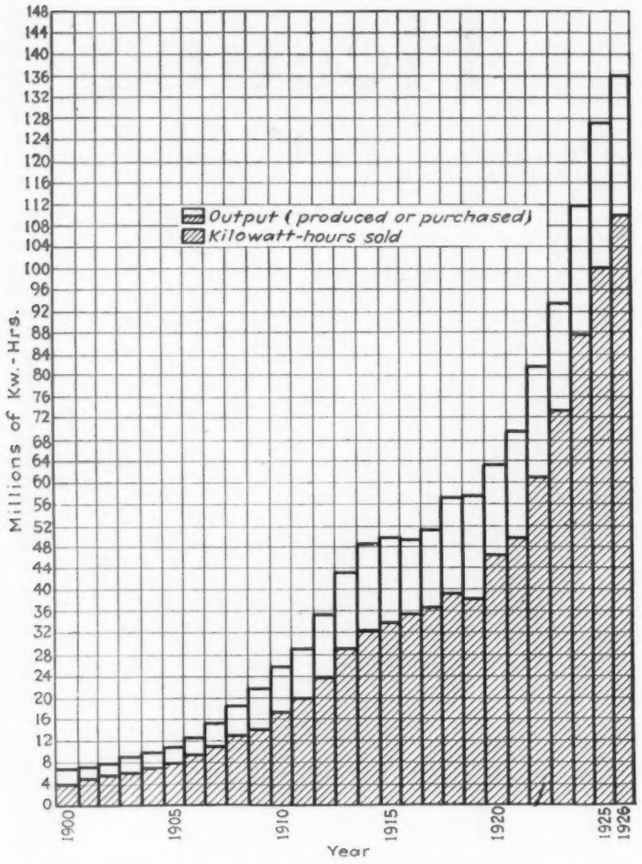
From observations of water heaters in Europe and this country, it can be said that public acceptance of the device depends almost wholly on its proper design, some points of which are here noted. The control valve is placed in the cold water pipe so that the pipe through which the water leaves is clear and permits the escape of any vapor that may be produced. The tank and all the pipes are heavily galvanized to prevent rusting. The electrical heating elements are installed so that they are easily replaceable and are not in direct contact with the water. The water enters at the bottom of the tank and leaves at the top. Units of large capacity are supplied with thermometers. The terminal screws for the heating element and the current regulators are standard. Cleaning orifices permit flushing of the tank. The tank is surrounded by a sheet iron outer container and with facilities for replacing the heating units and the temperature regulator. A good insulating material is considered essential to high efficiency of the device. The insulating material that has given the best satisfaction up to the present time is composed of granules of cork. Satisfactory operation of the heater depends upon the temperature regulator. In the smaller sizes of heaters a thermo element combined with a mercury interrupter is generally used; however, these interrupters do not always give satisfaction and it is better to use thermo elements and a relay for operating an automatic switch. This solution is naturally more expensive, but it has the advantage of eliminating a great amount of dissatisfaction and inconvenience to both the consumer and the company.



Utilization of night service for water heating in Strasbourg

Usual European heaters taking energy at 230 volts, sometimes 380 and 500 volts, and rated to raise water from 10 deg. C. to 90 deg. C. (40 deg. F. to 194 deg. F.) have the characteristics which are shown in Table I, on page 300.

A good 50-gal. storage heater well insulated does not lose more than 15 deg. in a period of 24 hours. The water may be stored for several days without great loss



Growth of Strasbourg Electric Company output and sales largely attributed to use of off-peak energy

in temperature. A bath requires about 20 gal. of water at 104 deg. F. It is obtainable by using 9 gal. of 160 deg. F. water and 11 gal. of cold water at 58 deg. F. This shows that the usable hot water from an insulated tank thermostatically controlled is nearly double the rated capacity of the tank. The approximate efficiency of these water heaters is about 90 per cent for the cork-insulated apparatus.

As an indication of the performance of these heaters there is presented here a copy of a test report made by the Swiss Association of Electricians' testing station at Zurich:

FORM OF REPORTING HEATER PERFORMANCE

Object Under Test—Domestic water heater.

Maker—Etablissements Electro-Mecaniques de Strasbourg, *Bischheim.*

Description of Apparatus—Water heater with a capacity of 26 gal. for mounting on a wall.

Nameplate—Etablissements Electro-Mecaniques de Strasbourg, S.A.R.L. No. 691, 100 litres, 10 atm. 125/250 volts, 1,200 watts, three phase (electro-cumul.)

Height of Exterior Case—52 in.

Diameter of Exterior Case—20 in.

The apparatus is provided with a thermometer and a temperature limiter. Insulation against loss of temperature is composed of grilled grains of cork.

Nature of the Tests:

(a) Determination of the time and consumption of energy to heat the content to a temperature about 194 deg. F.

(b) Determination of the fall in temperature of the content over a period of 48 hours.

Before the tests the apparatus was kept in service for a period of two weeks.

Results:

(a) Consumption of current with apparatus in warm state ..... 1,200 watts
Temperature of contents at beginning of test ..... 61.5 deg. F.
Temperature of contents at completion of test ..... 192.4 deg. F.
Duration of test ..... 7 hr. 40 min.
Capacity of apparatus ..... 26 gal.
Energy consumed by the apparatus—9.119 kw.-hr. ..... 7,840 calories
At the completion of the period of heating the water contained ..... 7,080 calories
Lost during the period of heating ..... 760 calories
Efficiency of apparatus during heating period ..... 90 per cent

(b) The temperature of the contents was measured at six points, equally spaced through the tank. The temperatures were measured at the surface of the tank by a thermocouple.

Near Temperature in Degrees F.

Hours After Switching Off	Average Temperature	Drop in Temperature Between Readings	Total Temperature Drops
0	194.4 deg. F.	.....	.....
1	193 deg. F.	1.4 deg.	1.4 deg.
6	182.3 deg. F.	10.7 deg.	12.1 deg.
12	173 deg. F.	9.3 deg.	21.4 deg.
24	157 deg. F.	16.0 deg.	37.4 deg.
48	130 deg. F.	27.0 deg.	64.4 deg.

Remarks—The insulation (grains of cork) was dried in the apparatus for two weeks before the test.

Table I—Characteristics of Some European Water Heaters

Gallons	Litres	Rating, Kw.	Kw.-hr. for Eight Hours
26.4	100	1.3	10.4
39.6	150	2.1	16.8
52.8	200	2.4	19.2
79.2	300	3.4	27.2
105.6	400	4.4	35.2
132.0	500	5.3	42.4
211.2	800	7.6	60.8
264.0	1,000	9.0	72.0

Table II—Comparison of an American and European Water Heater

Time, Minutes	Top Temperature, Deg. F. American	Top Temperature, Deg. F. European	Bottom Temperature, Deg. F. American	Bottom Temperature, Deg. F. European
0	70	70	70	70
30	102	77	72	71
45	109	81	72	75
60	124	85	72	75
90	138	93	73.6	87
120	149	102	75.4	95
150	158	109	77	103
180	165	117	79	112
240	178	133	82	129

Table III—Growth of Mixed Tariff Business

Compagnie Parisienne de Distribution d'Electricité

	1923	1924	1925
Number of mixed rate contracts	4,400	9,500	15,200
Power contracted, kw.	3,800	8,300	13,300
Consumption, thousands of kw.-hr.	418	3,050	3,600

Compagnie L'Ouest-Lumière

	1924	1925
Consumption, thousands of kw.-hr.	814	1,683

Table IV—Water-Heater Situation in Switzerland at End of 1925

	Inhabitants	No. of Heaters Installed	Total Capacity, Gallons	Mean Capacity of Heaters, Gallons
Neuchâtel	23,000	101	4,500	45
Lucerne	42,000	461	28,000	62
Berne	104,000	700	40,000	56
Geneva	129,000	2,163	62,000	29
Basle	140,000	3,535	182,000	51

Although the information in this article relates to foreign practices, it is of interest to note the results of competitive tests made on heaters of foreign manufacture as compared to the American product. It is the belief of the writer that the American-made water heaters, as far as design, appearance and efficiency are concerned, are superior to those of foreign manufacture. The results of tests comparing a European heater with an American unit are given in Table II.

The amount of heat necessary to hold a tank of water at 150 deg. F. in a room temperature of 75 deg. F. can be expressed in watts continuous loss. In the case of the European heater this loss was 109 watts or 78.5 kw.-hr. per month and in the American was 95 watts or 68.4 kw.-hr. per month. The rate of heating of water in the two may be judged from the data given in Table II.

American heaters are best adapted to American conditions on account of:

1. Better efficiency.
2. Larger tank which is necessary for night storage.
3. Quicker heating of water to usable point.
4. Positive thermostat.
5. Much better appearance.
6. Calrod units better than open units used abroad.
7. Proximity of factory for supplies, sales, service, etc.
8. Sales assistance.
9. Stand mounting better for this country than the bracket type commonly used in Europe.

It is of interest to note the rapid increase in kilowatt-hour sales and the change-over of customers of the Compagnie Parisienne de Distribution D'Electricité and of the Compagnie L'Ouest Lumière in the class of mixed-tariff business. The figures given in Table III are only for this class and do not include other business. The heater capacities in use in Paris, according to reports to the 1924 Lyons Fair, are 8 to 13 gal. for kitchen and washstand use and up to 53 gal. for bath. The power rating is from 35 to 45 watts per gallon and up to 500 watts the heating element is single phase. This report was made to the Lyons Fair of 1926.

The majority of the heaters referred to in Table IV are only heated with night current, generally from 10 p.m. to 6 a.m. Heaters of 20 gal. or more have a temperature regulating element. At the end of 1923 there were 25,000 heaters all over Switzerland containing more than 13 gal. and 12,000 accumulating stoves for room heating.

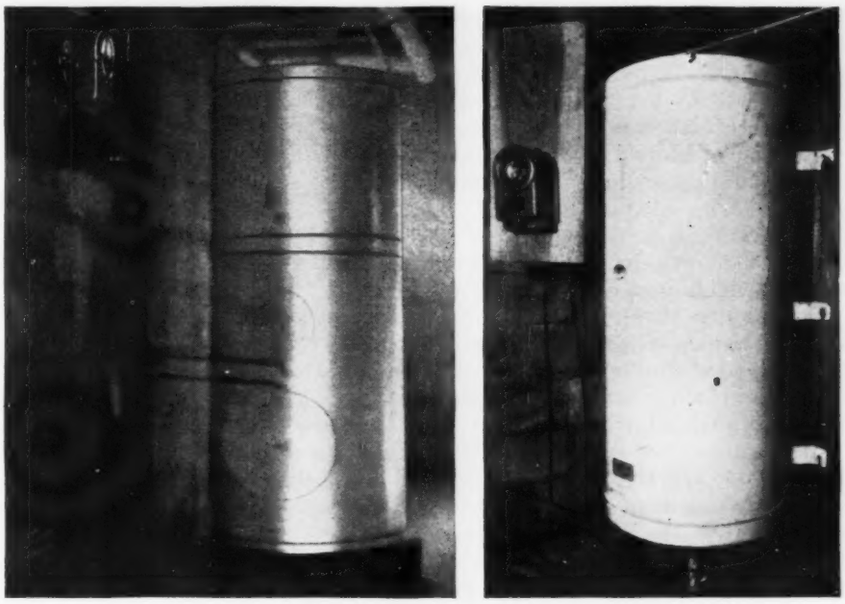
Through the use of the heaters referred to in Table V, the night load is generally between 60 and 80 per cent of the peak load.

Since the material contained in this article is of necessity rather fragmentary and disconnected, it should be considered only an indication of high lights rather than as a complete and detailed picture. Still it is believed that enough information is presented to demonstrate the enormous possibilities of the domestic water-heating load. The reason why this class of load has been so overlooked in this country is that American central stations have had such tremendous demands for service made upon them from their beginnings that load development as a utility function has been hardly recognized. We are coming to that recognition very rapidly and in reaching it we cannot afford to ignore the progress that has been made by our European brothers.

Table V—Number of Heaters Installed at Basle from 1917 to 1925

End of	No. Units	End of	No. Units
1917	109	1922	1,536
1918	320	1923	2,035
1919	422	1924	2,652
1920	520	1925	3,535
1921	747		

Total water heater connected load in 1925, kw	8,200
Total consumption in 1925, kw.-hr	14,000,000
Mean time of use	4 hours 40 minutes nightly



European 33-gal. and 26½-gal. heaters

These and other heaters were imported by the Middle West Utilities Company for study under American conditions. The two shown are in service on the lines of the Central Illinois Public Service Company.

Table VI—"Off-Peak" Tariffs in Switzerland

	Cents per Kw.-Hr.
At Basle, for night load	0.8
At Berne, for night load	0.8
At Berne, for day power	1.6
At Berne, for light	10.0
At Geneva, for night load	1.6
At Solothurn, for night load	0.4

Table VII—Pertinent Data Regarding Strasbourg Situation

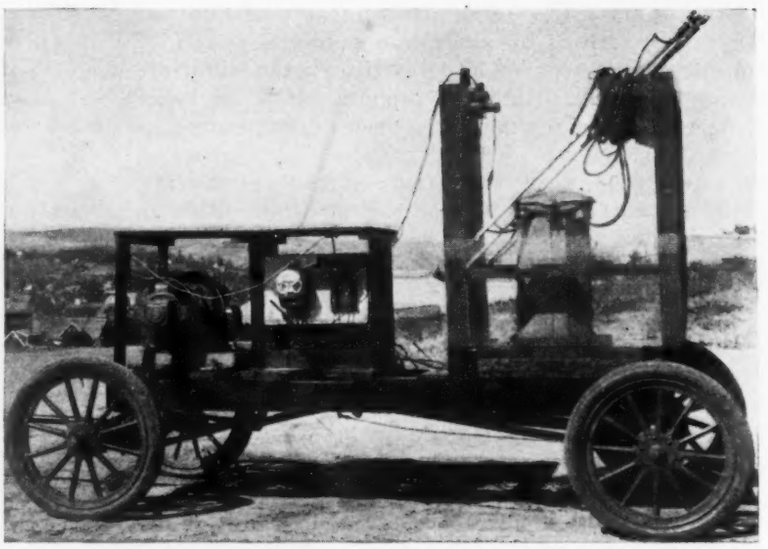
403 kitchen ranges with rating of 1,110 kw. and a consumption of 477,967 kw.-hr. (installhd during 1926).

Electric refrigerators in 1926, mainly night current (kw.-hr.)	460,358
Total energy sold, approximately, kw.-hr	110,000,000
Total capacity up to February, 1927, kw	55,380
Population, total territory served	521,790
Installations, connected (kw.) { Lighting 47,699 / Motors, 79,842	
Maximum 1926 peak, kw	37,500
Kilowatt-hour consumpti n per inhabitant (kw.-hr. per, year)	212

Table VIII—Rating and Unit Consumption of Water Heaters in Strasbourg

Gallons	Watts	Watt-Hours Monthly	No of Persons in Family
33	1,500	171	4
26	1,200	75	4
52	2,400	400	7
33	1,500	95	2
103	3,600	405	2
26	1,000	145	3
20	900	174	2
26	1,200	160	2
40	1,800	406	5
33	1,500	170	1
20	900	99	2
33	1,500	159	3
132	5,400	535	7

A study of the load conditions at Strasbourg definitely establishes the desirability of the development of the electric hot water heating load. When one considers that incomes in these countries do not compare in amount with those in this country, it is obvious that the possibilities for electric hot water heating in this country are enormous. Of course, other fuel costs are much higher than in this country, nevertheless there are hundreds of thousands of installations in this country which have not been reached by gas, or at a price that makes electric current competitive. These offer possibilities for this load. The 1926 report of Electricité de Strasbourg says: During the year 311 water heaters with a total capacity of about 1,200 gal. and 666 kw. were installed, making a total of 917 heaters on the system with a total rating of 1,470 kw. and a consumption of 1,646,478 kw.-hr. The information in Table VII regarding the company is of interest.



10-hp., single-phase motor with transformer and control equipment mounted on light truck for general farm utility work

Space was left between the control equipment and the transformer crib for mounting a reel to carry a portable cable to the motor. The two poles are used for making connection to the 2,300-volt primaries. The transformer is demountable and may be placed on a platform at the base of the pole where it is desirable to place the motor closer to the machine. This permits connecting infrequently used large motors to primary service.

Threshing with Electricity

By Harry L. Garver
Investigator Washington C.R.E.A., Pullman, Wash.

In an effort to determine the possible farm operations that could be done with a 10-hp., single-phase motor the Washington Committee on the Relation of Electricity to Agriculture built up a portable motor with transformer and control apparatus mounted on a Ford chassis, as shown in one of the accompanying illustrations. It was hoped that the outfit could be made a sort of community affair, carrying its own demand charges, thus reducing the burden on any one farmer, who probably would not require the services of a 10-hp. motor more than a total of two or three weeks per year. Such jobs as cutting silage, grinding feed, sawing wood and perhaps baling hay and straw were considered possibilities.

Fortunately one farmer had a small 20x28-in. J. I. Case separator equipped with a self-feeding device and a wind stacker. This had been operating with a 15-hp. stationary gas engine, but it was decided to try the motor. The average power requirement was approximately 8.5 kw. when threshing a bushel of barley per minute. The energy consumption for threshing 7,446 lb. of barley and 13,362 lb. of wheat and oats mixed was 90.3 kw.-hr. The straw was dry and about 30 in. long and in excellent condition for threshing. A few loads of wet, green oats were fed into the separator at the end of the threshing season. This was a real test and considerable care had to be exercised in feeding this wet grain. Even with careful feeding the motor would slow down quite noticeably when a very tough bundle went through the cylinder. When threshing dry grain the speed was practically constant.

It is difficult to make a comparison between any two

Electric thresher and separator on a Washington farm

threshing outfits, since no definite data are available giving variety, condition of straw, yield, weather conditions and many other factors affecting power requirements. In electric threshing tests made in England and on the Red Wing line in Minnesota the separators were equipped with ball bearings, while the machine used in Washington was fitted with soft metal bearings. The English test showed an energy consumption of 0.375 kw.-hr. per hundredweight of barley, but also included the baling of the straw. In the Red Wing test the energy consumption was 0.320 for barley and 0.335 per hundredweight for all grains threshed. Consumption in the Washington tests ran somewhat higher, averaging 0.434 per hundredweight for all grains, including the tough, green oats. It is probably safe to say that with well-filled grain in good condition the electrical energy consumption should average about 0.350 kw.-hr. per hundredweight of grain threshed.

Every report bears evidence of the steady power from the electric motor, resulting in better cleaning and less grain being thrown into the straw pile than with other types of power. This was especially true of the Minnesota tests, where one motor operated the cylinder, another the shaker and shoe and still another the stacker. Slugs and wet bundles had no effect on the speed of the cleaning devices.

The Washington test was made in the heart of the Palouse country, which is one of the great wheat-producing sections of the world, and while electric threshing would not likely be considered profitable in this section, where threshing is done on a large scale, it did all that could be expected of a small outfit and should be satisfactory on moderate-sized farms where greater diversification is practised and particularly where threshing is done from stacks near the farm buildings or in the barns.

St. Louis Street Lighting Practices Lead in Extent and Intensities

"EVERY major and minor street in the downtown area of St. Louis is a white-way with a standard of illumination which is in many cases higher than that found on the celebrated white-ways of the past," says L. A. S. Wood, manager of the street lighting section of the Westinghouse Electric & Manufacturing Company. "The St. Louis street lighting load is now 15,000 kw., all of which is purchased from the Union Electric Light & Power Company, although the city maintains its own street lighting systems."

Features of Street Lighting in St. Louis

Miles of streets lighted, approximately	650
Number of lighting standards, approximately	32,000
Miles of underground cable, approximately	1,200
Number of transformers (from 5 kva. to 80 kva)	845
Mounting height of lights:	
Intensified downtown area, feet	26
Intermediate area	19
Residential area, feet	15
Size of lamps:	
Intensified area	25,000 lumens (2,500 cp.) 15,000 lumens (1,500 cp.)
Intermediate area	10,000 lumens (1,000 cp.)
Residential area	1,500 to 6,000 lumens (150 to 600 cp.)
Total candlepower in downtown district	5,000,000
Total current consumption, kw.	15,000
Amounts expended:	
First contract	$1,230,238.00
Second contract	558,197.00
Third contract	803,431.00
Fourth contract, downtown	2,235,985.00

The installation and details of this municipal project are described in a special publication issued by the Westinghouse company, "Lighting St. Louis, the City of White-ways."

Letters from Our Readers

Dreaming of Future Line and Bus Insulation

To the Editor of the ELECTRICAL WORLD:

A recent description of a Swiss hydro station brought out the fact that wooden insulators were used on the 150-kv. buses and even on the gang-operated disconnecting switches for the same voltage. It was reported that they had a flashover value of 400 kv. and stood up satisfactorily under 21,000 in.-lb. bending and 3,000 in.-lb. torsion. Despite 2½ years of service not a single failure had occurred. Wood insulation is quite common in this country inside of oil circuit breakers and transformers and in a number of cases as strain units on 11,000-volt railroad catenary construction. But on high-voltage bus work and disconnecting switches, except for some 120-kv. lines in Colorado and Montana, it is practically unknown here. Of course, the Swiss plant referred to is an indoor installation, whereas practically all high-tension work in this country is outdoors, where effects of weather would have to be guarded against.

Considering future developments in voltage, would it not be worth while to conduct further research with treated wood or composition materials that would withstand weather conditions? Bus supports for heavy high-voltage duty are already quite expensive. Aside from transformers and breakers, material investment in an outdoor substation is made up largely of the cost of insulators for disconnecting switches and bus supports. Satisfactory porcelain units for these uses are produced by only a few manufacturers. Should it become necessary to go to higher voltages than 220 kv. mechanical difficulties would be encountered with the present method of making up an insulator post; i.e., mounting a number of porcelain units on top of one another. If built-up post insulators are used it would probably become necessary to use two or three stacks in parallel for each support, and the cost would mount to enormous proportions, unless new principles are found or old ones developed.

If transmission voltages grow to 500,000 volts or higher it will be necessary to use tubular conductors of considerable diameter, each phase-conductor on a separate post. The whole transmission right-of-way may have to be fenced off. For such voltages the height of the insulating supports would be as high as poles. It would then become necessary to develop tall insulating posts. Would impregnated, or otherwise treated wood or wood pulp specially manufactured into poles have any possibilities? Or would composition poles made of micarta or bakelite, possibly with glass flanges at intervals to create the leakage surface, be suitable? Only research and field experience will tell.

It is not desired to convey the idea that these materials are now suitable for such purposes, but merely to suggest that the time is ripe to look into the future and to begin investigations of practical solutions of the problems that may arise.

M. M. SAMUELS.
J. G. White Engineering Corporation,
New York City.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Second Hydro-Electric Plant on Chippewa River.—Located at Chippewa Falls, 2½ miles below Wissota Dam, is the new 21,600-kw. hydro-electric plant. The principal features of technical interest are the large propeller type adjustable-vane waterwheels, the unusually large Tainter gates on the spillway and the fact that the plant works practically on the tailwater and overflow from the larger 31,680-kw. Wissota plant, up the river. In order to give free discharge from the draft tubes and tail pit, a tailrace channel 270 ft. wide was excavated below the power house. The flow capacity of the spillway is 90,000 sec.-ft. for normal pond level and may be increased to 110,000 sec.-ft. by raising its level 2 ft. The large Tainter gates are equipped for both motor and hand operation. The motors of the two gates nearest the power house are arranged for remote control from the station switchboard in order properly to release excess water in case of loss of load or releasing surges of water that may result from change of conditions at the Wissota Dam.—*Engineering News-Record,* January 17, 1929.

Recent Developments in the Utilization of Bituminous Coal.—Important points on preparation, processing for the extracting of liquid fuels and other by-products, utilization in power generation, etc., brought out at the second international conference on bituminous coal in Pittsburgh.—*Mechanical Engineering,* February, 1929.

Reconstruction of San Francisquito No. 2 Power Plant.—H. B. GARDETT and A. R. ARLEDGE.—It is seldom that any group of men is called upon to rebuild completely a power plant that the same group built in the first place. The rebuilding of the San Francisquito No. 2 power plant, which was completely ruined by the disastrous flood of March 13, 1928, is unique. First the waterway had to be cleaned up and repaired. Then the salvaging and repairing of material from the original plant was taken on and finally the plant was rebuilt.—*Electrical West,* January 1, 1929.

Generation, Control, Switching and Protection

Large Two-Cylinder Condensing Turbines for a South American Power Station. — Two 50,000-kw. turbines shipped to the Argentine Republic possess noteworthy features allowing for subsequent conversion to high steam pressures. In order to meet the final steam conditions, the steam chests and the velocity compounded of the first stage will be replaced and one impulse stage will be added. The new velocity and single impulse stage will deal with a large proportion of the enlarged heat drop, so that the total steam volume passing through the remainder of the high-pressure stages, and especially through the low-pressure part of the turbine, remains the same, and therefore the turbine efficiency will flucuate but little under new service conditions. When finally completed, the high-pressure part will consist of one velocity compounded stage and fourteen single-row impulse stages with full admission throughout. The impulse wheels of the high-pressure turbine are forced separately on the shaft; the low-pressure rotor, which is rigidly coupled to the high-pressure shaft, consists of a two-piece drum drilled out so as to keep the unit weight low. At the same time the drilling affords a means of controlling the uniform strength of the forging. The turbine is doubly protected against overspeeding by a governor and by a mechanism which closes the main throttle if the speed exceeds the maximum.—*A.E.G. Progress,* January, 1929.

Transmission, Substations and Distribution

More Power for Eastern Ontario.—An exposition of the general development plans for the utilization of water power under the direction of the Hydro-Electric Power Commission of Ontario, with particular reference to the transmission facilities and interconnection arrangement. A number of transmission lines have been constructed and operating voltages range from 44 to 220 kv. Both wood pole and steel tower construction are used and the features of the transformer station, three-winding transformers, regulating equipment and protective devices have been pointed out.—*Electrical News* (*Canada*), December 15, 1928.

Reaction Converters and Their Application.—S. KATO.—The rotary converter will continue synchronous running when the shunt field circuit is opened, so long as the reluctance of the magnetic circuit is reasonably low. The machine is then called the "reaction converter." It is a well-known fact that the armature magnetomotive force at the commutating zone of a converter is very small compared with that of an ordinary direct-current machine, the former being about 15 per cent of the latter. This figure is with machines of 100 per cent efficiency and power factors or of very large capacity whose mechanical friction and iron losses can never be negligible. The power factor of the reaction converter, as in induction motors, improves with load, and the more rapidly if proper negative load be given to the direct-current brushes. In the latter case the longitudinal component of the direct-current armature reaction aids the magnetizing action and reduces the lagging part of the alternating current. Lagging of direct-current brushes hardly affects commutation, although the commutating field decreases in its positive value or reverses its direction. In such conditions, resistance commutation due to carbon brush contact may prove satisfactory, as is shown in actual cases. Reaction converters have the following qualifications: Cheap in cost, good efficiency and power factor, simplicity in construction and starting, smaller floor space.—*Journal of the Institute of Electrical Engineers of Japan,* December, 1928.

Units, Measurements and Instruments

The Measurement of Kilovolt-Amperes of Maximum Demand.—G. W. STUBBINGS.—A review of the methods commonly available for determining the maximum demand at the customer's premises. The author has considered successively the thermal demand indicator, compensated induction meter, aggregating meters and shaded pole motor demand indicator. In conclusion, it is stated that with the possible exception of one make of instrument, all the methods available are approximate and are subject to errors additional to those inherent in the instrument movements themselves.—*Electrical Engineer* (*Australia*), November 15, 1928.

The Time Lag of the Spark Gap.—J. W. BEAMS.—The conditions under which a spark gap in air may be overvolted for a considerable time without a disruptive discharge taking place between its terminals have been investigated. In this discussion overvoltage is defined as any voltage above the least voltage that will produce a disruptive discharge when applied for an indefinite period. The effect of ultra-violet light upon this phenomenon and the various time intervals involved have been investigated, both by the author and by previous research workers. In this discussion a new method of measuring the time lag is described and some of the lags for sparks in air at atmospheric pressure have been recorded. The field strength used ranged approximately from 60,000 volts per centimeter to 400,000 volts per centimeter with as steep wave-fronts as could be obtained. It is said that this method not only enables one to measure very short time lags which occur with high field strengths, but that the measuring device itself does not affect the result. The author subscribes to the theory of Zeleny that there is a dense adsorbed layer of molecules that covers the surface of electrodes in air and that this is a domi-

nant factor in the phenomena which the investigation covers.—*Journal of the Franklin Institute,* December, 1928.

No-Loss Air Condenser for Alternating-Current Bridges and Its Applications. — KAZUKIYO OGAWA. — Description of the principle and construction of a no-loss condenser for alternating-current bridges and some of its applications. The no-loss condenser is an air condenser of such construction that the insulators which support both plates of the condenser are all covered with metallic cases which are connected to earth. The air condenser of this construction has already been decribed by Giebe and Zickner and by Shackleton and Ferguson, but it was found to be remarkably beneficial to use the condenser in an alternating-current bridge with perfect grounding device. As some of its applications, the author gives the method of measuring the loss angle of ordinary condensers, the effective resistance and inductance of inductance coils, etc. The air condenser is also suitable as standard of capacity, since its capacity is constant for any frequency. The method of determining the capacity in terms of resistance and frequency is given.—*Journal of the Institute of Electrical Engineers of Japan,* December, 1928.

Illumination

Analysis of Fundamental Concepts of Illuminating Engineering. — L. SCHNEIDER.—The fundamental concepts of illuminating engineering, as judged by the author, are analyzed and discussed. The visual process and the relation of illumination to vision is studied in all of its three phases, namely, the physical, the physiological and the psychological, showing the way for improving the theory and the advancement of practice. It is emphasized that the starting point and the point of reference for all research work on lighting problems must therefore be where the changeover from the physical to the physio-psychological process takes place. This point is the image of the object viewed on the retina. The chief factors are given as the condition of adaptation, magnitude of the contrasts, size of the retinal image, abruptness of the contrast-transition, relative distribution of the brightness within the field of vision, and glare.—*Transactions of the Illuminating Engineering Society,* December, 1928.

The Lighting Transition in Motion-Picture Production.—R. E. FARNHAM. —Recent developments in the production of motion pictures have compelled a re-evaluation of such factors as desirable quality and quantity of light, correspondence of visual and photographic appearance, reaction of the cast, range of effects, efficiency of control, the time element, noises and other operating conditions, labor and energy costs. These factors are described in detail in the paper, with particular reference to the substitution of incandescent lamps for the former illuminants used in motion-picture production. Recommended placements of light sources and arrangement for the best results have been outlined in so far as the limiting prerequisites are concerned.—*Transactions of the Illuminating Engineering Society,* December, 1928.

Telegraphy, Telephony, Radio and Signals

A Direct Method for the Study of the Characteristics of an Acoustic Transmitting System.—K. KOBAYASKI. —The intensity of a sound field and volume of sound emitted by any surface can be measured directly and easily by using the vibrometer provided with a rigid piston diaphragm. Using these two functions, the image impedances at both ends of the hyperbolic angle, subtended by any acoustic transmitting system, can be determined. The theory and arrangement of apparatus used in the experiment are shown in detail, together with the experimental results carried out on some simple acoustic transmitting systems of well-known character. These results were surprisingly accurate. It is believed that the method can be used as a valid means for the study of the character of acoustic transmitting systems.—*Journal of the Institute of Electrical Engineers of Japan,* December, 1928.

Electrophysics, Electrochemistry and Batteries

The Maintenance of Mechanical Oscillations By Magnetostriction.—J. H. VINCENT.—In recognition of the comparative neglect by physicists in recent years of the connection between the vibration of ferrogmagnetic bodies and magnetostriction the author has undertaken an investigation both with soft iron and nickel. Determinations include investigation of the Joule effects and of resonant phenomena as produced under various conditions. Test procedures and variations to conform with various hypotheses have been fully described by the author.—*Electrician (England),* December 28, 1928.

Reaction of Water on Calcium Aluminates.—LANSING S. WELLS.—A careful investigation of the four calcium aluminates and the mechanism of their reaction with water has been analyzed in this discussion. The tricalcium aluminate reacted so rapidly with water that changes in the composition of the resulting solutions could not be followed. The other calcium aluminates, as well as a high alumina cement, reacted with water to form metastable and supersaturated monocalcium aluminate solutions in early periods. Calculations based upon electrometric measurements and chemical analyses indicate that the aluminate in solution is the calcium salt of monobasic aluminic acid. A study of the subsequent changes in the aluminate solutions, attended by increasing concentrations of calcium hydroxide, indicates that a hydrated tetracalcium aluminate may be formed in solutions under certain conditions.—*Bureau of Standards, Journal of Research,* December, 1928.

Heat Applications and Material Handling

Electrically Heated Boilers. — The electrically heated boiler is a byproduct of high-priced fuel during the war. It now has a use in that surplus or off-peak electrical power can be utilized for generating steam to be used during peak periods. Differentiation between electric hot water boilers, electric hot water accumulators, electric steam boilers and electric steam accumulators, clearly made. Boilers using up to 16,000 volts without transformers have been made, the loads ranging from 10 to 6,000 kw. Detailed description of the electrode type boiler.—*Engineering (England),* January 4, 1929.

Electric Rivet Heaters.—A new type of electric rivet heater developed by a British concern has been designed to give special attention to the securing of high efficiency. This device is, under certain conditions, capable of heating 8 lb. of rivets per kilowatt-hour and enabling, according to the author, a saving of approximately $300 per 100 tons of rivets as compared with other methods and other machines. This article points out a number of other advantages of this device.—*Engineer (England),* December 28, 1928.

Miscellaneous

On the Leakage Current of Electric Railway Tracks. — T. HATTORI. — A paper dealing with the leakage current running through underground structures laid near electric railway tracks. Based on the assumption that the currents which flow in and out of underground structures are delivered and received by the adjacent earth, the writer has determined the current and voltage of the earth near the track and then considered what will happen if the current strays into such structures, finally touching upon several problems concerning underground structures in general. In this way a very reasonable solution has been obtained, even when the length of these structures is smaller than the total length of tracks concerned. Further, calculations have been carried out for any lengths of structures with single and uniform loads on rails respectively, and experiments have been made with models to confirm the results of calculation. Moreover, some remarks are given on the value of the practice of electrically cutting off underground structures by using insulated joints in them to minimize the corrosive effect of current flowing through them.—*Journal of the Institute of Electrical Engineers of Japan,* December, 1928.

Book Reviews

The Principles of Electric Power Transmission

By H. Waddicor. New York: John Wiley and Sons, Inc. 395 pages, illustrated. Price, $6.

This is a thoroughly up-to-date text on power transmission and contains a good balance between theory and practice. The author has searched the existing literature and used the best presentations and data available and he has exercised very good judgment in his choice of topics. In a few chapters he deals with elementary economic considerations, inductance and capacity and the performance of short lines. He then discusses the long transmission line equations and gives chapters on structures, conductors, insulation and voltage control. A valuable chapter so frequently missing in transmission books deals with underground cables. General economics, protective equipment and an analysis of line control are also chapters in the text. This book should be very useful in colleges and to many transmission engineers.

Mechanical Power Transmission

By William Staniar. New York: McGraw-Hill Book Company, Inc. 406 pages, illustrated. Price, $5.

A book for engineers and plant men dealing with the features of mechanical drives. Belting and belt drives are treated at length, and clutches, ropes, friction drives, gear drives and other methods are discussed and illustrated.

Introduction to Theoretical Physics

By Leigh Page. New York: D. Van Nostrand Company, Inc. 582 pages, illustrated. Price, $6.50.

In this text Professor Page has given a clear and logical treatment of modern theoretical physics. The step-by-step treatment, with ample illustrations, permits of a clear and logical presentation of the topics. The five major divisions discussed are: Dynamics, hydrodynamics, thermodynamics, the Kinetic theory of gases, electro-magnetism and optics and spectroscopy. The treatment is mathematical and rigid and is a welcome addition to advanced physics literature.

Die Gleichstrom-Querfeld Machine

By Dr. E. Rosenberg. Berlin: Julius Springer. 97 pages, 102 illustrations.

The cross-flux machine, often called the Rosenberg generator, has been used for car lighting since 1904. Latterly, fitted with regulating poles, it has found wide application for arc welding, which fact has directed the interest of a new group of users to its operating principles, to whom the earlier publications are not readily accessible.

The logical writer of a book on a new device is the inventor. Dr. Rosenberg has presented a thoroughly readable description of his dynamo, abundantly illustrated with diagrams and characeristic curves. Mathematical analyses by Kuhlmann and Hahonemann and by Thomalen are given in a separate short chapter near the end. By no means the least interesting feature, introducing a human element not usually found in technical treatises, is the story of the invention, which constitutes the final chapter. A bibliography is appended.

Memoirs and Addresses of Two Decades

By J. A. L. Waddell, D.E., LL.D., consulting engineer; edited by Frank W. Skinner, consulting engineer. Easton, Pa.: Mack Printing Company. 1175 pages. Price, $5, postpaid.

This, the *magnum opus* of one of America's eminent civil engineers, is a truly informative and inspirational work. It shold be of profound and lasting value to all earnest engineers, be they students or practitioners. The student-engineer will find much sound, practical, and therefore very helpful, advice in Dr. Waddell's searching analysis of the personal, educational and professional requirements necessary for success in any phase of modern engineering. He is almost certain to be awed by the tremendous amount and the rich variety of work which the author has successfully carried on for many years, not only in his own field but also in other fields, notably that of technical education. In this realm the famous engineer wrought enthusiastically and unceasingly for the establishment of more inclusive as well as more practical college curricula and also for the advancement of scholastic standards among both professors and students.

The student, be he freshman or postgraduate, will be drawn especially to those portions of the book which show so eloquently and conclusively that a really successful engineer's life is above everything else a life enriched and ennobled by intelligent and unselfish service to one's fellowmen. No matter what his special aims in life may happen to be, he will do well to follow in the footsteps of Dr. Waddell. The reading of this pioneer's memoirs should imbue every student with ideals, fire him with ambition and impress him with the opportunities which beckon the engineer who loves his work, who maintains high standards, even in the face of unscrupulous competition, and who in his dealings with his clients and the public in general is fair.

The practising engineer will treasure this 1,100-page volume of addresses, monographs and other papers as the record of an unusually active and successful engineer's life. He will admire its authoritativeness, appreciate its clarity and applaud its humanness.

The volume proper consists of more than seventy papers. These are grouped under convenient headings: The Engineering Profession; Ethics of Engineering; Technical Education; Engineering Literature; Economics; Bridge Construction; Matters Chinese, and Miscellaneous. All are helpful papers.

Electric Drive Practice

By Gordon Fox. New York: McGraw-Hill Book Company, Inc. 415 pages, illustrated. Price, $3.50.

The selection and application of motors and the essential elements in electric drives are elements that make a very useful book for many engineers. Mr. Fox discusses typical electrically driven commercial machines in use today. He shows the effect of load on motor size and characteristics and deals at length with the several drive mechanisms available. Typical industrial drives are discussed at length.

Book Notes

PRODUCTION DESIGN. DESIGN AND SPECIFICATION AFFECTING QUANTITY MANUFACTURE OF METAL PRODUCTS. By J. K. Olsen. 207 pages. New York: McGraw-Hill Book Company, Inc. 207 pages, illustrated.

This book deals with designs, tools and processes in metal manufacture whereby quantity production is obtained. It gives tolerances in manufacture that are permissible and is replete with practical details.

DISCUSSION OF THE NATIONAL ELECTRICAL SAFETY CODE. By Department of Commerce, Washington, D. C., U. S. Government Printing Office. 33 pages, illustrated. Price, $1.

This supplement to the fourth edition of the National Electrical Safety Code is devoted to a discussion of the rules. Owing to extensive rearrangement of the old rules the discussion has likewise had to be rearranged. Parts 1 to 3 inclusive cover installation and maintenance, Part 1 referring to electric supply station, Part 2 to overhead and underground lines and Part 3 to utilization equipment. Part 4 covers operation of equipment and lines. Part 5 discusses radio installations.

Books Received

Englische Elektrizitatswirtschaft. By Gunther Brandt. Berlin: Julius Springer. 112 pages.

Industrial Carbon. By C. L. Mantell, New York: D. Van Nostrand Company. 410 pages, illustrated. Price, $4.50.

Handbook of Refrigerating Engineering. By W. R. Woolrich. New York: D. Van Nostrand Company, Inc. 331 pages, illustrated. Price, $4.

Bauelemente Der Feinmechanik. By O. Richter. Berlin VDI-Verlag G.m.b.H. 576 pages, illustrated.

The Radio Manual. By George E. Sterling. New York: D. Van Nostrand Company, Inc. 666 pages, illustrated. Price $6.

Der Quecksilberdampfgleichrichter. By K. E. Muller. Berlin: Julius Springer. 348 pages, illustrated. Price, 42 reichsmarks.

News of the Industry

Yes, There Is a Power Monopoly, Says Pinchot

Six Major Financial Interests Dominate It, and It Is Guilty of Financial Inflation, Extortion, Blacklisting, Subterfuge and Intimidation of Authorities

GIFFORD PINCHOT, former Governor of Pennsylvania, has just issued a 256-page publication entitled "The Power Monopoly—Its Make-up and Its Menace," in which he elaborates his well-known views on electric utility and holding companies. He maintains that 3,108 operating companies are controlled by 41 large holding companies, 887 by 125 smaller holding companies, 126 by 31 investment companies "allied with the power interests," while 85 operating companies are entirely independent.

"There is an electric power monopoly," Mr. Pinchot declares in his introduction, "organized and financed, not for fair and efficient public service, but for ruthless exploitation, uninterrupted and unrestrained by anything approaching effective government intervention or control." The subsidiaries of the 41 big holding companies generate, according to him, 82 per cent of the total output of energy. But this is not the worst. "Grouped under the dominating financial interests on their boards of directors," he says, 23 of the 41 fall, as regards their control, into six divisions—General Electric, Samuel Insull, J. P. Morgan & Company, A. W. Mellon, H. M. Byllesby & Company and Henry L. Doherty & Company. Mr. Pinchot, for example, places Detroit Edison and Boston Edison in the General Electric group, Philadelphia Electric and U.G.I. in the Morgan group and Pacific Gas & Electric in the Byllesby group.

Then there are, the Governor says, twelve great electric corporations under the joint control of ten different groups. In eight of these Morgan figures. Here are the names of these interlocked financiers:

Morgan—Ryan—Brady
G.E.—Morgan—Byllesby—Doherty
Morgan—Ryan—Brady—Rockefeller
Morgan—Mellon—Aldred
G.E.—Morgan—Brady
G.E.—Morgan—Ryan—Brady
G.E.—Morgan—Harriman
Mellon—Byllesby
Mellon—Doherty
Morgan—Insull

This leaves only six "unidentified" power corporations, to wit: Associated Gas & Electric, Buffalo, Niagara & Eastern Power, General Gas & Electric, North American, Southern California Edison and Utilities Power & Light.

A list of the 4,362 operating companies with their putative affiliations, lists of holding, investment and independent companies, as well as balance sheets, names of officers and subsidiaries of the 41 big holding companies, are included in the publication. Among Mr. Pinchot's comments is the following:

The harm and danger of the power monopoly is not due merely to its monopolistic nature nor even to its enormous size. Its menace is due much more to certain other factors, which may be summarized as follows:

1. The monopoly has been created by financial inflation.
2. The financial inflation of the monopoly has been supported by extortion.
3. This inflation and extortion are made possible and perpetuated by the control of investments secured through the blacklisting of investment houses which may refuse to sell the monopoly's inflated securities to the public.
4. Having forced its inflated securities on American investors, the monopoly now dodges behind these investors for protection against the arm of the law in much the same fashion that meaner elements of lawlessness, like common highwaymen, frequently have used their victims as shields against the bullets of policemen.
5. The power monopoly, fully conscious of its financial, industrial and legal powers, as well as its extra-legal powers for evil, is seeking now in the open and in the dark, by fair means and by foul, to seize or continue control over the powers of government or, failing in this, to intimidate lawful authority to do its will.

Lamme Medal Is Awarded to Allan B. Field

Before the adjournment of the winter convention of the American Institute of Electrical Engineers at New York last week announcement was made that the Lamme medal committee of the Institute had awarded the first (1928) Lamme medal to Allan Bertram Field, consulting engineer of the Metropolitan-Vickers Electrical Company, Manchester, England, "for the mathematical and experimental investigation of eddy-current losses in large slot-wound conductors in electrical machinery." Arrangements for the presentation of the medal will be announced later.

Lamme A.I.E.E. medal

The Lamme medal was founded as a result of a bequest in the will of the late Benjamin G. Lamme, chief engineer of the Westinghouse Electric & Manufacturing Company, who died on July 8, 1924, to provide for the award by the Institute of a gold medal (together with a bronze replica thereof) annually to a member of the American Institute of Electrical Engineers "who has shown meritorius achievement in the development of electrical apparatus or machinery" and for the award of two such medals in some years if the accumulation from the funds warrants.

Mr. Lamme made similar bequests to the Society for the Promotion of Engineering Education and the Ohio State University, providing in the former for the annual award of a medal "for accomplishment in technical teaching or actual advancement of the art of technical training," and in the latter for the award every five years of a medal to a graduate of the Ohio State University in any branch of engineering for meritorious achievement in engineering or the technical arts. The three organizations have adopted a common obverse for their medals and each has prepared a suitable reverse.

A brief biographical sketch and a portrait of Mr. Field are printed in "News About Men of the Industry" (page 316).

Canadian Supreme Court on Dominion Rights

Navigation Must Not Be Prejudiced by Provinces' Jurisdiction Over Water Powers Within Their Boundaries, Says Indecisive Judgment

JUDGMENT was given on Tuesday by the Supreme Court of Canada in the reference case instituted by the government to define the respective rights of the Dominion and the provinces over water power on navigable rivers. In an incomplete answer to the series of questions submitted to them the judges assert that the provinces have a right to use the water powers in provincial rivers and to develop or authorize the development of water powers within their respective limits, provided that navigation is not prejudiced. The finding appears to uphold the right exercised by the Quebec Legislature in authorizing a lease to the Beauharnois Power Company, though clearly the Dominion government will make the decision whether or not navigation is prejudicially affected in this case.

The judgment follows the power reference argued before the Supreme Court in Ottawa last October. In the reference there were ten questions, but all of these have not been answered decisively, and the case will eventually be referred to the Privy Council in England for final decision. The ownership of water powers generally is not at issue. The Dominion government does not question the fact, as laid down by the Privy Council, that the provinces

own the beds of the streams. The central question rather is whether when the Dominion constructs a work for the improvement of navigation, and power is developed from such work, it belongs to the Dominion as a matter of right or whether the province must be compensated.

Some of the questions are answered in a way construed as favorable to the federal claim; some again favor the provincial contention, and some, the court says, cannot be answered either affirmatively or negatively. The court decided that it could not answer "yes or no" to the question whether the Dominion has the power, for navigation purposes, to occupy the beds of provincial navigable rivers without the consent of the province or without compensation. The provinces, the court holds, have neither a proprietary interest in nor beneficial ownership of such subjects as are comprehended under the phrase "water power" in the schedules of the British North America act. The court decides furthermore that, in the absence of a precise statement as to the character of the works or the authority under which they were executed, it is impossible to ascertain the respective rights of the parties to water powers created or made available by reason of extensions, enlargements or replacement of works, for the improvement of navigation, by the Dominion authority. Similarly, the court is unable to give a clear answer as to the respective rights of the Dominion and provinces with respect to powers in boundary waters and treaties thereupon. In view of the form of the questions, it answers "no" to the interrogation whether the provinces can control, regulate or use the waters of a provincial navigable river even though navigation is not interfered with.

Still Fight Boulder Dam

Western Legislatures Wrangle Amid Seven-State, Six-State, Four-State and Three-State Complications

THE Swing-Johnson measure is a law, but reverberations of the still-continuing fight over Boulder Dam come from the legislatures of the Colorado River Basin states.

In Arizona a resolution denouncing in very strong terms the Boulder Dam project, the Swing-Johnson act and both the seven-state treaty and the proposed three-state compact has been introduced in the Lower House. The resolution, if adopted, will bind Arizona to fight to the last ditch against the "encroachment of the pernicous activity of those still seeking to rob Arizona of its heritage." The Legislature has passed a bill authorizing a new Arizona Colorado River commission consisting of Governor Phillips and four men appointed with the approval of the Senate.

In the Wyoming Legislature two measures seeking withdrawal of Wyoming's ratification of the Colorado River compact until the four upper states have agreed to an allocation of the water have been introduced. Should this effort prove successful, those behind it would stand in favor of a seven-state ratification but opposed to ratification by six of the states.

Governor Balzar of Nevada has been unsuccessful, at latest advices, in an effort to arrange a conference of the three lower basin states at Reno. Governor Young of California accepted, but Governor Phillips of Arizona wanted the conference held at Phoenix and wished to add Governor Dern of Utah to the conferees.

A threat to throw the Colorado open for private power developments has been made by Boulder Dam advocates at Washington who believe that in this manner they can force the approval of the states now opposed to the project.

House Committee Rejects Shoals Bill

American Cyanamid Offer Not to Be Reported—Myers Thinks Utility Inquiry Will Take Two Years More—Bill to Prevent Broadcasting by Utilities

By Paul Wooton
Washington Correspondent for the Electrical World

BY A VOTE of ten to eight on Thursday morning the military affairs committee of the House of Representatives decided not to report the Madden Muscle Shoals bill, which presented the offer of the American Cyanamid Company for the properties of the government at Muscle Shoals. This bill had the active support of the American Farm Bureau Federation and of many members in both houses of Congress, and prospects for its passage were thought favorable by its advocates. On the other hand, there was much criticism of its terms, the Alabama senators, for instance, declaring that it contained "no semblance of a guarantee for fertilizer manufacture" and would inure to the benefit of the Alabama Power Company, the executive secretary of the Federal Power Commission being understood to maintain that its recapture clause did not protect the government, and the President's opposition being assumed because the bill provided for government construction of Dam No. 3 and also of the Cove Creek dam. It may be regarded as all but certain that no further attempt at Muscle Shoals legislation will be made by this Congress.

Two Years' More Inquiry

Another hearing in connection with the Federal Trade Commission's investigation of electric and gas utilities will be held on February 14, when Herbert C. Jones, a member of the California Senate, will testify. He was in charge of an inquiry made by the California Legislature into the publicity activities of power companies in connection with the state water-power bill. Victor M. Hartley, executive secretary of the California Electrical Bureau, also has been called to testify at this hearing. A considerable number of documents having a bearing on the publicity phase of the investigation have been prepared and will be made a part of the record on the same date.

That the investigation will require at least two years for completion is revealed by the release of the testimony of former Chairman Myers of the commission, when the House committee was considering the item appropriating $1,209,760 for Federal Trade Commission expenditures. Mr. Myers, however, did not commit himself absolutely to a two-year estimate. "I have tried to make myself believe," he said, "that by diligent application to the work and with support, and not opposition, in the industry and in other places the work could be completed in two years." He went on to say that the industry "has co-operated very fully and very fairly with the commission in carrying out its task under the resolution," and that "in due time and at the proper place the commission will be bound to make that acknowledgment." He mentioned that there was one exception.

In the course of his testimony Mr. Myers expressed the opinion that the utilities have a perfect right, as has any industry, to tell their story openly to the public. The only vice he could see in the situation was where the origin and motive of the propaganda were not disclosed.

Radio Broadcasting by Utilities

Legislation that would preclude the issuance of broadcasting licenses to any public utility company has been introduced by Senator Black of Alabama. It also provides that no portion of the stock of a broadcasting company may be owned by a public utility. It is not expected that this amendment to the bill to extend the life of the Federal Radio Commission will prevail. In fact, there is doubt as to the passage of the bill. O. H. Caldwell, whose resignation from that body has been tendered to the President, expressed the opinion in recent testimony before the House committee that there is no more reason to deny permits to public utility companies than there is to deny them to newspapers, department stores or other agencies. This opinion was brought out when he was asked whether he agreed with the position of Chairman Robinson and Judge Sykes to the contrary.

Were the Black idea adopted, it would preclude the Radio Corporation itself from broadcasting, as it is engaged in public utility work in the communication field. It also would revoke licenses held by electric light companies in Boston, Baltimore, Chicago and Indianapolis.

In the States' Legislative Mills

Commissions Urged for Delaware and Kentucky, Terminable Permits for Missouri—Indiana House Passes Bill to Exempt Municipal Plants from Control

UTILITY and commission bills and resolutions are getting to the voting stage in some of the state legislatures. Despite endeavors to abolish the regulating body in commonwealths here and there, some Kentucky and Delaware Solons are emulating fellow-legislators in Texas by endeavoring to set one up.

DELAWARE. — With annual regularity a bill is placed before the State Legislature at Dover proposing the establishment of a public service commission. Such a measure has been introduced every year for eight or ten years and each time has been defeated. This year a bill sponsored by Representative Clark provides for the appointment of a commission of three members by the Governor to serve for two, four and six years, successors to be appointed for six-year periods. A salary of $2,500 is provided. The measure would give the commission full jurisdiction over all utilities in the state.

INDIANA.—In spite of strenuous efforts to kill the McKesson-Murden bill to remove municipally owned utilities from the control of the Indiana Public Service Commission, it has passed the House of Representatives, an attempt to substitute a minority report favoring indefinite postponement being defeated by 58 to 41. The fight will be resumed in the Senate.

A bill has been introduced by Senator A. H. Lindley authorizing the Attorney-General to employ an attorney and an engineer to represent the public in rate increase cases. The bill provides that the Deputy Attorney-General, appointed for four years at a salary of $6,000 a year, shall be assigned to the Public Service Commission to represent consumers. The engineer would receive the same salary and also be appointed for four years. It would be his duty to obtain information to assist in combating rate increases.

KENTUCKY.—"Kentucky's welfare demands that the next Legislature shall pass a comprehensive act placing the control of water-power development and the regulation of public utility rates in the hands of a responsible governmental agency," is the declaration of Lieutenant-Governor James Breathitt, who is chairman of a committee named by the Kentucky Senate during the last General Assembly to make a study of the public utility question in Kentucky and to submit recommendations for legislation to the next session. "Kentucky is one of a very few states having no adequate laws on the subject of public utility regulations and no method whatever of governing the development of its water power."

MASSACHUSETTS. — Representatives of the Municipal Plant Association and the gas and electric lighting associations of Massachusetts combined forces at a legislative hearing in Boston on Tuesday of this week in opposition to the McGlue and Leahy bills relaxing the present restrictions against the entry of cities and towns into municipal ownership. Proponents of the bills confined themselves to attacking the prices for service of private companies. The McGlue bill would permit a city to acquire a plant on a majority vote of the city council or of the electorate at a regular or special election. The Leahy bill would allow a municipality to establish a plant for street lighting and other city or town service without going through the present legal routine.

M. F. Weston for the Municipal Plant Association declared that the organization is opposed to the entry of cities and towns into the field of electrical supply unless backed by genuine and continuous public sentiment.

MISSOURI.—Substitution of terminable permits for the present fixed-term franchises of public utility corporations in Missouri is provided in a bill, sponsored by public utility interests, introduced in the House by Representative James T. Blair, Jr., of Cole County. A similar bill was passed by the House of the 1927 Legislature, but did not get through the Senate. This measure, if adopted, would give the utilities what amount to franchises for an unlimited misuse or non-use.

NEW YORK.—Prohibition of the acquisition of stock of public utility corporations by dummy owners is sought in a bill introduced at Albany by Assemblyman Post of New York. It is provided that every disposition of the securities of a public utility corporation shall be made directly to the person in whom the title and the right to profits are intended to be vested. Each public utility corporation is required to make semi-annual reports to the commission showing the ownership of all securities, and stock brokers must report their purchases with full information.

OKLAHOMA.—Bills to repeal the revocable permit law have, as usual, been introduced in both houses.

OREGON.—Electric light and power representatives are opposing the proposed repeal of the law covering certificates of convenience and necessity and in that way prohibiting the incursion of competitors into fields already entered. Advocates of the repeal contend that the act as it exists gives the commission greater powers than any three officials should be intrusted with and also that competition in the utilities industry should not be curbed by any law.

Yielding under pressure brought to bear by various Oregon municipalities, the Legislature has indefinitely postponed action toward enacting a law to authorize county assessors to include upon their tax rolls the properties of all municipally owned utilities. The proposal was advocated by a special committee appointed by a previous legislature and was actually incorporated in a bill.

WASHINGTON. — The big immediate issue before the Legislature is water power, especially as affected by the district power bill (initiative measure No. 1). This bill was briefly described on January 19 (page 162).

Legislators from the smaller counties do not favor any project that threatens to remove taxable property from the tax rolls, and the bill is not likely to pass. The proposed bill removes the utility commissioners from supervision of the Department of Public Works and further provides full powers in fixing rates. Legislators have three forms of action: (1) Passage of the bill, which would make it a law, subject to its being held up by referendum petitions; (2) rejection of the bill, which would automatically bring it before the voters at the 1930 election; (3) passage of the bill with a referendum clause attached. The third method would have the same result as the second, but would give the bill a vote of approval.

Meantime a bill has been filed in the House at the request of Governor Roland H. Hartley requiring "every person, firm, private or municipal corporation claiming the right to the use of water within the state for power development" to pay in advance on January 1 of each year an annual license fee. The basis of fees fixed in the bill is 50 cents for each theoretical horsepower up to and including 1,000 hp., 2 cents for every theoretical horsepower from 1,000 to 10,000, and 1 cent for every theoretical horsepower in excess of 10,000. For undeveloped projects the fee would be at one-half the other rates. This measure would tax the big power plants of the cities of Seattle and Tacoma. J. D. Ross, superintendent of the Seattle municipal plant, and Kenneth Harlan, utility engineer of the Tacoma municipal plant, are said to favor it.

Another measure before the House is a constitutional amendment to be voted on in 1930 which would permit taxation of all municipally owned property used for public utilities other than for water systems.

WISCONSIN.—Assemblyman Malchow of Green Bay has presented a bill providing that "all rules, regulations and general orders promulgated by any state commission or board shall be valid and binding only when they have been enacted and become a part of the statutes of the state." Another bill proposed by him makes it the duty of the Railroad Commission, at the request of any county, city or village affected by a proposed increase, to furnish at the expense of the state, one or more competent experts from employees of the commission, familiar with valuations, statistics and investigations, to aid the applicant.

Roosevelt Power Plan for St. Lawrence

New York Governor to Confer with Legislators of Both Parties Before Announcing It—Senator Wagner Wants His Aid on Niagara Proposals

GOVERNOR ROOSEVELT of New York announced on Monday at Albany that he would send a message to the Legislature within the next two weeks defining his water-power policy and containing recommendations for its application, the details of which are to be worked out in advance in conference with both Democratic and Republican legislative leaders. The Governor said that prior to the conferences he would not be drawn into any discussion of water power for publication and intimated that probably nothing would come from the executive chamber in advance of his official communication to the Legislature.

There is therefore no guarantee that the widely published details of "the Roosevelt plan" are authentic. These represent the Governor's ideas as much like those of his predecessor except that the device of a "water-power authority" to issue non-taxable bonds for the construction of the plant is absent. Under the plan, as the newspapers have printed it, the state would put up $300,000,000 to build dams and power houses and would sell the generated electricity over the busbar to private companies for distribution. The power interests would put up $200,000,000 to be used for erecting a network of transmission lines that would blanket the state, as well as substations and other equipment necessary to distribution. In effect, the Roosevelt development plan, as unofficially forecast, would provide a trusteeship in which the people, through the state, would have control of the power resources while the power interests would distribute and resell the power generated.

Wagner on Niagara Falls Plans

United States Senator Wagner of New York in a letter made public this week called upon Governor Roosevelt to announce the attitude of New York State toward the treaty recently negotiated between the United States and Canada for the preservation of the scenic beauty of Niagara Falls and the diversion of additional waters from Niagara River for power purposes. In this letter, declaring himself in favor of the state retaining the ownership and control of water power at its source, the Senator asked these questions:

1. Do you favor the proposal to have the work of preserving the Falls undertaken at private expense and, simultaneously therewith, making available for private utilization by the Niagara Falls Power Company the additional water to be diverted under the convention for a temporary period?

2. Does the State of New York claim that its consent is a prerequisite before any disposition can be made of the additional 10,000 sec.-ft. made available by the convention?

3. Does the State of New York claim the right to charge for the use of such additional water the rental provided for in Subdivision 13 of Section 613 of the conservation law?

As previously reported, the Niagara Falls Power Company, stands ready to build at its own expense the American part of the remedial works provided for in the international convention for the preservation of Niagara Falls. It would share with the Ontario Hydro the water temporarily diverted. These works would cost about $2,000,000.

Recent Purchases and Mergers

Six Companies Combined to Form Empire Public Service Corporation—Insull Vermont Utilities to Be Merged, as Are the Two in Louisville

FORMATION is announced of the Empire Public Service Corporation in order to acquire six companies—the Electric Public Utilities Company, the Southwest Utilities Corporation, the Home Electric Light Company, the Antietam Electric Light & Power Company, the Midland Electric Light Company and the Emmitsburg Electric Company—with combined assets of about $35,000,000 and comprising power systems in Ohio, Maryland, Colorado and Oklahoma, as well as gas and water plants. The Electric Public Utilities Company is a Chicago holding company, which controls subsidiaries in Wooster, Findlay, North Baltimore and Rudolph, Ohio; Caney, Kan.; Golden, Colo., and Hominy, Okla., and which acquired the Home, Antietam, Midland and Emmitsburg companies, small Maryland concerns, late last year after the courts had upset two contrary decisions by the Maryland commission (Electrical World, November 3, 1928, page 904). Plans of the management call for expansion of the system within the next few months through the acquisition of additional utility properties.

The Vermont Hydro-Electric Company has just announced plans to merge seven power companies, covering the greater part of Vermont and having assets exceeding $15,500,000, into a single system to be known as the Central Vermont Public Service Corporation. Virtually all the properties are controlled by the Insull interests and are connected physically with the New England Power Association and utilities in New York State. The companies are the Vermont Hydro Electric Company, the Rutland Railway, Light & Power Company, the Pittsford Power Company, the Public Service Corporation of Vermont, the Middlebury Electric Company, the Windsor Electric Light Company and the Bradford Electric Light Company.

Stockholders of the Kentucky Utilities Company and its subsidiary, the Kentucky Hydro-Electric Company, will be called on to ratify, at stockholders' meetings early in March, a proposal of the former to acquire the properties of the other company, including the Dix River Dam power station, transmission lines to Louisville and Lexington and its other hydro-electric plant on the Kentucky River. These are Insull companies belonging to the Middle West Utilities Company group.

Announcement is made by the Kentucky Electric Development Company, Louisville, of the purchase of an ice plant at Liberty, Ky., and of the equipment and franchises of the Kentucky Service Company, in Yosemite and Middleburg, Ky. At Liberty a generating station will be built, and it is also planned to install a small hydro-electric plant at Middleburg.

Final steps for the acquisition of the Boonville (Ind.) Electric Light & Power Company by the Southern Indiana Gas & Electric Company of Evansville have been taken, but the terms of the sale are not made public. The Southern Indiana company is a subsidiary of the Commonwealth Power Corporation of New York.

Voting strongly for a bond issue to expand the municipally owned electric and water plant at Rochelle, Ill, the citizens have ended negotiations for its sale to the Illinois Northern Utilities Company for $650,000.

Purchase by the Illinois Power & Light Corporation of the Okawville light and ice plant from William G. Frank is announced.

The Iowa-Nebraska Light & Power Company has leased the Pawnee City (Neb.) municipal plant and has bought for $123,000 its distribution system. Two years ago the voters defeated a proposal to sell for $120,000.

Rather than expend $40,000 in increasing the capacity of its plant, the City Council of Sidney, Neb., has asked the Western Public Service Company to make an offer for it. The voters turned down an offer of $350,000 made by the company two years ago.

The City Council of Hooker, Okla., has accepted a bid of $86,000 from the Panhandle Public Service Company for its municipal light and power plant. This will be subject to approval by a vote of the people. Citizens of Noble, Okla., by a vote of 69 to 0, have approved the sale of the city's electric distribution system to the Oklahoma Gas & Electric Company.

The stockholders of the Buffalo, Niagara & Eastern Power Corporation have approved the consolidation of the company and its subsidiaries to form the Niagara Power Corporation in accord with plans already noted.

Sale of the Macedon (N. Y.) Lighting Company to the Rochester Gas & Electric Corporation is under consideration. The price has been set at $26,000. Action is expected early in March.

Nashville (Ga.) authorities have declared void a contract made with the Southeast Georgia Power Company a year ago, which included the sale of the municipal plant to that company for $52,000, and have made a new contract for power with the South Georgia Power Company at Valdosta. The city claims that the Southeast Georgia Power Company did not live up to its part of the contract.

Brief for Cumberland Falls License Filed

History of Project Recited to Meet Charges of Haste and of Endeavor to Set Up Dummies in Order to Shield Insull Interests

OPPONENTS of the Cumberland Falls power project in Kentucky waited for more than three years after the original application for a preliminary permit was made before submitting a single objection to the development. This is one of the points made in a brief just filed with the Federal Power Commission by the Cumberland Hydro-Electric Power Company, applicant for a license to develop this site. In connection with the application a largely attended public hearing was held at Burnside, Ky., on August 10, 1923, and not one voice was raised in opposition to the granting of the permit on the ground that it might impair the beauty of the falls. More than $100,000 worth of engineering work was done under the preliminary permit. The investigations were satisfactory, and application for license was made March 17, 1926. It was more than a year after the preliminary permit had been granted before any protest was made. The application for license has been pending nearly three years. Thus virtually seven years have elapsed since the original application for preliminary permit was filed. This, the brief maintains, answers the inquiry of "Why the haste to appropriate Cumberland Falls?"

In a contract between the Cumberland Hydro-Electric Power Company and the Middle West Utilities Company the latter agreed to keep alive an option on adjacent lands and, should it be necessary, to acquire the property at the option price of $200,000. About two weeks before the date of the expiration of the option it was learned that the owner of the property had given an option to a representative of Senator du Pont to become effective immediately upon the expiration of the utility company's option. This made it necessary for the Middle West company, the brief states, to comply with the contract.

Attention is also called to the reply of Samuel Insull to the letter of Senator du Pont asking that they join in turning over Cumberland Falls to the State of Kentucky for a public park. Mr. Insull replied to that letter, commending the generosity of Mr. du Pont and advising him that the Middle West Utilities Company was not a free agent, as it was obligated to the Cumberland Hydro-Electric Power Company, which was controlled by Indianapolis interests and by E. H. Rollins & Sons of New York. In that letter Mr. Insull suggested that Stephen Mather, one of the leaders of the opposition, should take up the matter with Rollins & Sons. So far as can be learned this was not done. The charge that the Insull interests are undertaking to interpose dummies between themselves and liability to the public is denied flatly.

Much attention is given in the brief to exaggerated and unfounded statements made in the fight against the project. The brief of the opposing counsel contained the statement that the development would cause the "destruction of the falls by developing from 97 to 99⅓ per cent of the normal flow of water." The applicants quoted various authorities to establish that 52.6 per cent is the correct figure.

Good Sectional Meetings of Pacific Coast Association

Sounding the keynote of the second general meeting of the Commercial Section of the Pacific Coast Electrical Association, held in Los Angeles on January 17 and 18, G. B. Buck, commercial manager of the Public Service Company of Colorado, who made the trip to Los Angeles to address the meeting, said: "The battlefront of the future for the commercial man is on the doorsteps of America." With a series of cartoons to aid in bringing out his points, he made a distinct impression on the 150 men assembled, bringing out forcefully the fact that the industry's greatest potential market for increased energy sales is in the home. In his opinion man power and proper organization are the chief needs.

All committees reported excellent progress in their year's work. One of the most important activities of the Commercial Section this year will be a power-company employee essay contest on the subject "Why I Should Like to Have a 'Red Seal' Home." Fifteen thousand booklets will be distributed to central-station employees to aid them in preparing their essays and suitable prizes will be awarded to the winners. A third and final general meeting of the section for the year will be held in Fresno on March 21-22.

Intensive interest in committee work and a large attendance marked the mid-winter "conclave" of the Engineering Section of the same association, held simultaneously in Los Angeles. Notable progress was reported in the work being conducted by the hydraulic power committee, the prime movers committee, the apparatus committee and the overhead systems committee. At a joint meeting of the latter committee with the inductive co-ordination committee discussion indicated no serious obstacle to the use by California utilities of a common primary and secondary neutral. The joint investigation into this practice by communication and power interests has been completed and reports are being compiled. Communication interests have presented a suggestion acceptable to their interests whereby the common netural could be used by California companies, and upon study of this by power interests definite action will be taken. A third and final general meeting of the Engineering Section will be held in Fresno during April.

Miller Gives Details of California Edison Budget

John B. Miller, chairman of the Southern California Edison Company board of directors, has just made public some details of that company's budget for 1929, totaling $29,000,000. "Among the larger items," he says, "are $1,609,000 for additional hydro-electric facilities at Big Creek in the High Sierra, $5,250,000 for the second unit of our 750,000-kw. steam plant at Long Beach and $15,000,000 for extensions to the distributing system. At Big Creek a

Nature Floodlights Wausau (Wis.) Station

WAUSAU, Wis., is far enough north to witness striking displays of the aurora borealis. The picture above shows the hydro-electric generating station of the Wisconsin Valley Electric Company at Wausau West as it was recently photographed by means solely of the light from the sky.

new generator of 40,000 hp. capacity will be installed at Plant No. 8, bringing the total capacity of the company's water-power plants to 626,000 hp. At Long Beach work is already well under way on a 134,000-hp. steam generator, which is a duplicate of the one put into service last August. Remarkable efficiencies have been obtained in our new steam plants, the total steam-plant capacity now being 455,000 hp., and the total generating capacity, both steam and water, 1,072,000 hp."

Plans have been made by the Edison company for a five-year building program of $130,000,000, Mr. Miller added.

Boston Edison Seeks to Build Plant at Everett

An important step preliminary to the later construction of a major steam generating plant at Everett, Mass., appears in a petition filed with the Massachusetts Department of Public Utilities by President Charles L. Edgar of the Edison Electric Illuminating Company of Boston for authority to exempt certain land and tidal flats bordering on the Mystic River from the zoning laws of Everett. The company has acquired options on 743,000 sq.ft. of marsh and 690,000 sq.ft. of flats in connection with a plan to build a station there to supply part of its load in the north metropolitan area.

An Eighteen-Million Budget for Consumers Power

Nearly $18,000,000 will be spent by the Consumers Power Company on construction and improvement work in Michigan in 1929, with an added $467,188 for the Southern Michigan Light & Power Company, according to Charles W. Tippy, vice-president and general manager. Of these appropriations $11,971,966 will be used in the electric department of the Consumers company. Major expenditures are to cover additions to generating plant and transmission equipment. Two new generators at the Saginaw River steam plant will increase the station capacity to a maximum of 140,000 kw. At the Wealthy Avenue steam plant in Grand Rapids one new boiler will make it possible to obtain the maximum capacity of a new 20,000-kw. generator, making the total station rating about 42,000 kw. A new generator will be installed in the company's hydro plant at Lyons.

Two major transmission-line projects are provided for—one a 140-kv. circuit from Saginaw River to Flint and the other the rebuilding of the present line from Croton Dam to Muskegon for 140 kv. pressure. Two new carrier-current high-frequency telephone installations will be made, one at the generating center on the Au Sable River and one at Croton Dam. Slightly less than $3,500,000 will be spent on the Consumers distribution system and about $225,000 on the Southern Michigan distribution. A new office building in Battle Creek is included in the budget.

Buffalo, Niagara & Eastern to Spend Six Millions

A total of $6,604,140 has been appropriated in the 1929 budget of companies associated with the Buffalo, Niagara & Eastern Power Corporation for expanding and improving the electrical system of the Niagara area during the coming year by building lines and substations and enlarging the capacity of existing substations. Work on distribution lines is by far the largest item, with a total of $5,065,000. Other provisions include $1,194,000 for building transmission lines, $1,583,000 for building substations and enlarging the capacity of existing stations, $1,389,000 for work on generating plants and $562,000 for miscellaneous improvements and expansions. Considerable money will be appropriated for rural service.

P. G. & E.'s New Steam Plant to Reach 225,000 Kw.

Later details of the plans of the Pacific Gas & Electric Company noted on page 260 last week indicate that that company is making preparations to build in San Francisco the largest generating plant on the company's system, much exceeding in rating its 109,000-hp. hydro plant known as Pit No. 3. The Station A steam plant at Twenty-third and Louisiana Streets will be rebuilt and eventually converted from about 63,000 kw. to 225,000 kw. The new plant will be built in units and will take five years to complete.

Work on the first two units, each of which will be rated at 50,000 kw., will begin at once. Three of the largest boilers ever built have already been designed for these units, and plans for the first two turbo-generators are well under way. As stated last week, the boilers will operate at 1,400 lb., which is the highest pressure yet applied on the Pacific Coast. A smokestack 24 ft. in diameter and 200 ft. high will carry off gases from the fuel, but combustion will be so complete that there will be no noticeable smoke.

"The first unit," says A. F. Hockenbeamer, president of the company, "will be in operation early in 1930. The second unit will be ready six months later. These two units alone will cost $5,500,000. Other units will go in as fast as needed, and at the end of 1934 the station will be completed and represent a new investment of more than $11,000,000. The new station will be used to make up shortages in water power and as a standby for emergency service in case lines go down or mountain plants fail. It will also be used from time to time to produce base load and assure an ample supply of power for the commercial and industrial growth of the San Francisco Bay region. The station will be tied into the general transmission system of the company, and in emergency its output of power will be available for the whole bay area, from San Francisco to San Jose and around the bay to Oakland, Berkeley and Richmond, and even across the Golden Gate, by cables, to Marin, Sonoma and adjoining counties on the north."

Big 1929 Electric Budget for New Jersey Public Service

Details of the construction budget of $22,000,000 for 1929, just approved, for the electric department of the Public Service Electric & Gas Company, Newark, N. J., include as a major item $4,276,000 for interconnection purposes. The greater portion of this appropriation will be used on the so-called "southern leg" of the company's interconnection program, which will tie in the Public Service and Pennsylvania Power & Light systems with that of the Philadelphia Electric Company.

The "northern leg" of the interconnection with the Pennsylvania Power & Light Company and a portion of the "southern leg" were provided for by an appropriation of $4,655,000 in former budgets. This amount included the site for the Roseland switching station (the interconnection point), the Roseland-Bushkill right-of-way and the 44-mile steel-tower transmission line between these two places in addition to the equipment at Roseland station. Construction of the "southern leg" will include a single-circuit high-voltage steel-tower transmission line from Roseland switching station to the Delaware River near Lambertville, 48 miles distant, and the installation of a 90,000-kw. transformer bank with the necessary switching equipment at Roseland and of synchronous condensers at Roseland and Athenia.

The electric program also provides more than $3,000,000 for the construction of a tower transmission line between Metuchen and Trenton and for various other lines necessary for increased facilities to consumers. The line from Metuchen to Trenton is for the purpose of reinforcing the service now being supplied to Trenton and adjacent territory. The appropriation provides for a double-circuit steel-tower line from the Metuchen switching station to the Trenton switching station and for the installation of switching equipment at both stations.

Nearly $3,500,000 will be spent for new substations, extensions of existing substations, for reinforcements and for purchase of land upon which substations will be built in the near future, and about $1,500,000 will be used for additional transmission facilities at various substations. For extensions to new customers, for addtional transformer services and meters approximately $4,000,000 has been assigned. For distribution lines and equipment approximately $3,000,000 has been appropriated. This item provides for distribution circuit reinforcements and underground distribution conduits and cables. For generating plants, office and storeroom facilities and for new laboratory equipment over $1,500,000 will be expended.

Briefer News

GEORGIA HYDRO-ELECTRIC COMPANY TO EXPAND.—More than $1,000,000 is to be spent for the improvement and expansion of the property of the Georgia Hydro-Electric Company, according to an announcement just made by D. L. Evans, general manager of the company, which operates a steam plant at Griffin, Ga., and a hydro-electric plant at High Falls, near there.

TO ENLARGE WASHBURN (N. D.) GENERATING PLANT.—C. S. Kennedy, general manager of the Otter Tail Power Company at Washburn, N. D., announces that the company will spend $250,000 next summer in enlarging the local plant to house an additional steam turbine and boiler, with auxiliary equipment. More than 300 miles of power line are to be built.

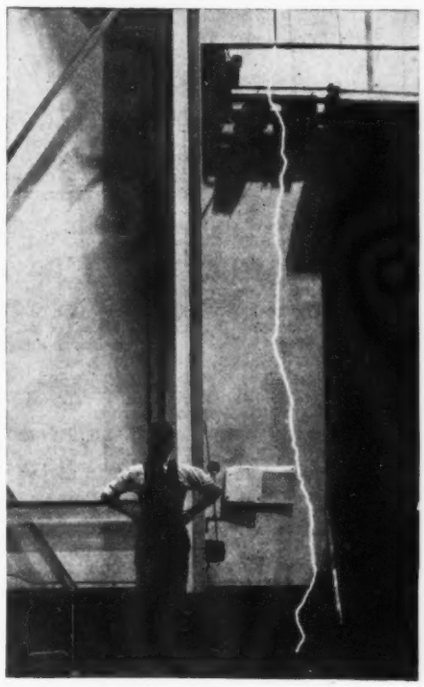
GREENSBORO, N. C., STICKS TO DUKE SYSTEM.—By vote of 1,320 to 400 the people of Greensboro, N. C., have approved the granting of a 50-year franchise to the North Carolina Public Service Company, subsidiary of the Duke Power Company. There was little outspoken opposition, and the franchise had a good majority in all the precincts of the city, although the total vote was extremely light.

RATE REDUCTION FOR KNOXVILLE, TENN.—A reduction in electric rates which will save customers approximately $50,000 a year has been announced by C. H. Harvey, president of the Knoxville (Tenn.) Power & Light Company. The new rates become effective March 1. Home owners will be the principal sharers in the reduction. They will pay for a ten-room house using 100 kw.-hr. a monthly bill of $6.90 as compared with $8.20 under the old rate, and for a five-room house using 50 kw.-hr. a bill of $3.50 as compared with $4.10.

ONTARIO HYDRO BUILDING 115 MILES OF 110-KV. LINE IN WESTERN PART OF PROVINCE.—The Ontario Hydro-Electric Power Commission is constructing between Pelham and St. Thomas, in the western part of the province, a distance of 115 miles, a 110-kv. transmission line at a cost of $2,000,000. About 35 miles has been constructed, and it is hoped to complete the line to St. Thomas about the beginning of August this year. By reducing losses, it is expected that 30,000 additional horsepower will be available to municipalities in the district.

KENTUCKY UTILITIES COMPANY PROGRAM.—L. B. Herrington, president of the Kentucky Utilities Company, has indicated that special attention will be given this year to pushing rural electrification. The company now has 2,670 farm customers. Its general extension budget for this year will reach $1,270,000, not including the proposed Cumberland Falls development, which would cost about $7,000,000. Numerous small projects in the shape of short transmission lines, new substations at Noubert and Morganfield and so forth make up the program. The company also plans to disprove the theory that a hydro plant makes a dreary waste about it by spending about $100,000 at its Dix River plant to beautify that property.

FIVE MILLION VOLTS OF ARTIFICIAL LIGHTNING.—Here is a double-exposure photograph of the 5,000,000-volt flash of artificial lightning discharged in the Pittsfield laboratory of the General Electric Company and described by F. W.



Peek at the recent winter meeting of the American Institute of Electrical Engineers.

PARIS, TENN., GETS ITS PLANT BACK.—Paris, Tenn., a place of about five thousand people, which leased its plant to the Kentucky-Tennessee Light & Power Company for 35 years, with an option to buy, will get it back if the decision of Federal Judge H. B. Anderson is upheld. The court sustained a charge of bribery made by the city and also found the price inadequate. The city must repay the company the latter's expenditures.

ELECTRICAL PROGRESS IN ALBERTA.—More than three thousand new connections were made last year in the central portion of Canadian Province of Alberta, and about two thousand customers changed from limited direct-current service to twenty-four-hour alternating current. This extensive district is served by the Calgary Power Company and the Canadian Utilities, Ltd., a subsidiary of the International Utilities Company, which together have constructed 1,200 miles of 13,000-volt to 66,000-volt lines into various districts in Alberta with the idea of eventually consolidating them into large systems.

TIDE POWER COMPANY GOES INTO RECEIVERSHIP IN MASSACHUSETTS.—By decree of the Massachusetts Superior Court a receiver will liquidate the affairs of the Universal Tide Power Company, a volutary trust with an authorized capitalization of $10,000,000, which was to promote the development of electrical energy from the rise of ocean tides at the mouth of the Saugus River. The receivership follows a petition filed two years ago by stockholders and investors.

KEEPING UP WITH RAPID GROWTH OF HUNTSVILLE, ALA.—By the construction of a line from its substation at Huntsville, Ala., to the center of the business activity of the city, the Alabama Power Company has completed a construction program that doubles the power facilities there and gives Huntsville ample power to keep pace with its rapid growth. The new line cost approximately $50,000 and runs from the west end of the town to West Clinton Street.

SEEKS WATER POWER FROM THE SKOOKUMCHUCK.—Charles I. Signer, formerly city engineer at Olympia, Wash., has applied to the state hydraulics supervisor for permission to withdraw 300 sec.-ft. of water from the Skookumchuck River, in Thurston County. He plans a 4,000-hp. hydro-electric plant, with a dam 110 ft. high, 160 ft. long at the top and 40 ft. at the bottom. It would require three years to build, cost $600,000 and serve Olympia, 20 miles north, and Centralia.

LARGE WHOLESALE-RATE CONTRACT AUTHORIZED IN NEW HAMPSHIRE.—The Public Service Company of New Hampshire, with headquarters in Manchester, has received authority from the Public Service Commission of the state to sell a minimum of 7,500,000 kw.-hr. of electrical energy to the Parker-Young Company of Lincoln at an average rate of two-thirds of a cent, on condition that any losses incurred shall not be borne by the public. The commission also stipulates that the company shall annually, on January 1, file a detailed account of the investment necessary to carry out the terms of the contract. This is said to be an entirely new departure on the part of the New Hampshire Public Service Commission.

CLEVELAND ELECTRIC ILLUMINATING COMPANY'S 1929 PLANS.—Because of the coming installation, already announced, of another 35,000-kw. turbo-generator at Avon station—the main item in its 1929 budget of $11,000,000 for improvements and extensions—the Cleveland Electric Illuminating Company will use the transmission towers of its new line from Avon to Fowles

substation to string the wires for a second circuit, hitherto not required. Other undertakings include a new bank of condensers and a new switch house, probably at Clinton substation; a new substation at Union Avenue and East Seventy-ninth Street, where current will be stepped down from 66,000 volts to 11,000 volts; a substation at Canal Road, to be built as a wing of the station now there, and various improvements at about eighteen other substations.

TOLEDO TIES IN WITH INTERCONNECTED SYSTEMS.—Toledo has just become a link in the network of 132-kv. power lines extending from Chicago to Pittsburgh and further south by a connection made at the new Ironville substation of the Toledo Edison Company. The Toledo system is thus tied in with the Cleveland Electric Illuminating Company, Ohio Power Company, Duquesne Light Company and other lines. The connection will put 30,000 kw. at the disposal of the Toledo plants, which now are running near capacity.

RURAL CONFERENCE FOR JACKSONVILLE.—In pursuance of its program of co-operation with the geographic divisions of the N.E.L.A. in holding rural conferences, the rural electric service committee of the parent association, of which committee Charles F. Stuart of the Northern States Power Company is chairman, will join in a third conference, to be held at Jacksonville, Fla., on February 13. The first conference was held in Dallas, Tex., last November and the second (reported last week, page 261) at Minneapolis on January 28 and 29.

COMING IMPROVEMENTS AT DES MOINES.—C. A. Leland, Jr., vice-president and general manager of the Des Moines (Iowa) Electric Light Company, announces that in 1929 it will construct a 44,000-volt line from its plant southeast of the city, to encircle half of the Des Moines area; will erect substations at Valley Junction and South Des Moines and will push rural extensions. A total expenditure of about $375,000 is involved. The 44,000-volt line will replace an existing 13,000-volt line system and have capacity sufficient for 300,000 population.

HOUSTON LIGHTING & POWER COMPANY'S BUDGET.—The Houston (Tex.) Lighting & Power Company will spend $6,172,927 on improvements during 1929 if its budget is approved by the City Council. About $2,544,000 is for a new 50,000-kw. turbine at the Deepwater plant, where a 35,000-kw. unit has just gone into commission. When this new unit is completed the company will have 155,000-kw. capacity. Other items are: New substations and improvements to existing substations, $143,720; transformers, $110,000; distribution system, $478,664; transmission system, largely for developing the belt line, $1,085,515, and underground system, $440,878. A substation will be constructed near Bellaire, making the fourth within the circle of the city.

CONFLICT OVER LEWIS RIVER HYDRO SITES.—Conflicting applications for two hydro-electric power sites on the Lewis River in the west-central section of Washington State are noted by the state hydraulics supervisor. One of the sites is near the village of Cougar, almost on the Clark-Cowlitz county line, while the second is at Tum Tum Canyon, about four miles distant. At this point the Lewis River, 57 miles eastward from its confluence with the Columbia, has a flow estimated at 700 sec.-ft. Some time ago the Inland Electric Power Company made application to the Federal Power Commission for both sites. A preliminary filing for the same sites has just now been made at Olympia by George McCoy of Vancouver, Wash., as president of the Southwest Washington Power League.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for January 5, page 80.]

Midwest Power Conference — Chicago, Feb. 12-16. G. E. Pfisterer, 53 W. Jackson Blvd., Chicago.

New England Division, N.E.L.A.—Engineering Section, Hotel Statler, Boston, Feb. 13-14. Miss O. A. Bursiel, 20 Providence St., Boston.

Vermont Electrical Association—Burlington, Vt., Feb. 15. L. E. Merrow, Montpelier, Vt.

New Mexico Utilities Association — Franciscan Hotel, Albuquerque, Feb. 18-20. Bernard L. Wiles, Albuquerque Gas & Electric Company, Albuquerque, N. M.

North Central Electric Association — Commercial Section, Minneapolis, Feb. 25 and 26. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Iowa Section, N.E.L.A.—Operators' Section, Sioux City, Feb. 26-27. H. E. Weeks, Davenport, Iowa.

Northwest Electric Light and Power Association — Commercial Section, Spokane, Wash., Feb. 28 and March 1; Engineering Section, Walla Walla, Wash., March 25-27. Berkeley Snow, 1206 Spalding Bldg., Portland, Ore.

Oklahoma Utilities Association — Huckins Hotel, Oklahoma City, March 12-14. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

American Institute of Electrical Engineers—Regional meeting, Cincinnati, March 20-22; regional meeting, Dallas, Tex., May 7-9. F. L. Hutchinson, 33 West 39th St., New York.

Arizona Utilities Association—El Conquistador Hotel, Tucson, April 18-20. Lee C. McCullough, 134 South Central Ave., Phoenix.

Middle West Division, N.E.L.A.—Hotel Fontenelle, Omaha, Neb., April 24-26. T. A. Browne, Lincoln, Neb.

Southwestern Division, N.E.L.A. — Arlington Hotel, Hot Springs, Ark., April 30-May 3. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Southwestern Public Service Association—Hot Springs, Ark., April 30-May 3. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Arkansas Utilities Association — Arlington Hotel, Hot Springs, Ark., April 30-May 3. R. I. Brown, Arkansas Power & Light Co., Little Rock, Ark.

Eastern Central Division, N.E.L.A.—Louisville, Ky., May 7-10. D. L. Gaskill, Greenville, Ohio.

Southeastern Division, N.E.L.A.—Asheville, N. C., May 8-10. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

National Electrical Manufacturers' Association — The Homestead, Hot Springs, Va., May S. N. Clarkson, 420 Lexington Ave., New York.

American Electrochemical Society—Toronto, May 27-29. C. G. Fink, Columbia University, New York.

National Electrical Wholesalers' Association—The Homestead, Hot Springs, Va., May 27-31. E. Donald Tolles, 165 Broadway, New York.

DATES SET FOR A.I.E.E. MEETINGS.—Besides the dates already noted for the 1929 regional meetings of the A.I.E.E. —Cincinnati, March 20-22, and Dallas, May 7-9—the Pacific Coast convention has now been fixed for Los Angeles on September 3-6 and the Great Lakes regional meeting for Chicago December 2-4.

A SERVICE STORY WITH A MORAL.—The Public Service Company of Colorado was ousted about two years ago from the city of Loveland, Colo., the city taking over the electric light and power business and erecting a hydro-electric plant. Very recently the engineer of the Loveland municipal plant informed Clare N. Stannard, vice-president and general manager of the Public Service Company, that the long-drawn-out freezing weather which had prevailed in the mountains had so checked the water flow that the city's plant was inadequate to Loveland's needs. Men were hurried to the scene, connections were made with the company's transmission lines, and Loveland was saved from going back to oil lamps and tallow candles.

FOURTH UNIT AT FARMERS RAPIDS, ON THE GATINEAU, IS TURNED OVER.—The fourth 24,000-hp. turbo-generator of the Gatineau Power Company's Farmers Rapids plant was turned over on February 1. Including it, the Gatineau company is now generating the grand total of 436,000 hp. at its three plants on the Gatineau River, in the Province of Quebec. This total is made up of the four units at Farmers Rapids, four units at Chelsea of 34,000 hp. each, and six units installed at Paugan Falls, of 34,000 hp. each. In addition to this installation a further generation of 126,000 hp. is projected. Farmers Rapids is to have another unit of 24,000 hp., making the total units there five; Chelsea also is designed for a fifth unit of 34,000 hp., and Paugan is to have two more 34,000-hp. units.

REMOVING OBSTACLES TO TABLE ROCK PLANT ON WHITE RIVER, MO.—An effort to compromise the differences between Stone County, Mo., and the Henry L. Doherty interests regarding the construction of the proposed hydro-electric dam and power plant at Table Rock, Mo., at an eventual cost of many millions is being made by Judge M. M. Cobb of the Stone County Court, who has asked for the construction of a bridge across the lake to be created by the dam, an adequate road outlet between the James and White Rivers, a

bridge over Indian Creek and an agreement relative to the taxes to be paid Stone County on the dam project. The Empire District Electric Company has already obtained a state permit for the construction of the dam, but final action on a federal permit has not yet been taken.

NEBRASKA'S MANUFACTURER-MUNICIPAL PLANTS ATTACKED.—The widely exercised right of Nebraska municipalities to make contracts with manufacturers of electrical equipment by which the latter construct lighting plants and take payment in warrants containing a condition that they shall be redeemed out of future net earnings is attacked in the Supreme Court by taxpayers of Sargent, the Council of which contracted for a new plant to be built by Fairbanks, Morse & Company. The challenge is based chiefly on the allegations that the statutes nowhere grant such power to a municipality and that they authorize only one method of building municipal lighting plants—that is, out of the proceeds of bond issues.

SEVEN-MILE LINK EXTENDS INTERCONNECTED AREA IN SOUTHWEST.—Interconnection between the transmission lines of the Central Power & Light Company and the Comal Power Company, subsidiary of the San Antonio Public Service Company, has been effected at Luling, Tex., by which not only the lines of these two companies but those of other systems in Texas, Louisiana, Arkansas and Oklahoma become connected. The final link was a seven-mile stretch constructed jointly by the two companies named. Its completion interconnects the San Antonio Public Service Company for the first time with lines of the Central Power & Light system covering the Gulf Coast, the Guadalupe and Colorado River valleys and the Texas rice-belt territory. These lines were already interconnected with major electric transmission systems extending through Houston and Beaumont and far into Louisiana.

CALIFORNIA RAILROAD COMMISSION TAKES CREDIT FOR EQUALIZING LIGHT AND POWER RATES.—According to the California Railroad Commission, customers of small electric utilities throughout the state will benefit very materially in 1929 by the efforts of the gas and electric division of the commission to bring about an equalization of the light and power rates of the small utilities with those of the larger and more efficiently operated power companies in their immediate vicinity or in the same class of territory. Because of its efforts, the commission says, electric consumers served by the Pinole Light & Power Company will enjoy the same rates as are charged by the Pacific Gas & Electric Company and Great Western Power Company. So also will customers of the Bay Point Light & Power Company. Customers served by the Sierra Pacific Power Company will also receive the benefit of the lower rates.

ALLEGED POLITICAL CONTRIBUTIONS FROM WINNIPEG ELECTRIC COMPANY TO BE INVESTIGATED.—A royal commission has been appointed in Manitoba to investigate charges leveled at the provincial government by Colonel F. G. Taylor, Conservative leader, in connection with the leasing of the Seven Sisters Falls power site by the government to the Winnipeg Electric Company. The two principal points on which the commission has been asked to pronounce are whether any campaign funds came to the Bracken government or party from the Winnipeg Electric Company and whether any promises were made in connection with the alleged payment of such sums. It is charged that $50,000 was contributed directly or indirectly.

Commission Rulings

NO CONTRACTUAL RIGHTS BASED UPON FRANCHISE ALONE EXIST IN COLORADO BETWEEN MUNICIPALITY AND PUBLIC UTILITY.—Although the Colorado Public Utilities Commission has no jurisdiction over the purchase and sale of the property of public utilities, it does have the right to issue or withhold certificates of public convenience and necessity. It therefore declared the absorption by the Public Service Company of Colorado of the La Jara Electric Company null and void because the latter had no such certificate and declared that no contractual rights could exist in such a case between a municipality and a utility. A preliminary order granting a certificate was granted to pave the way for the desired merger.

MEASURES TO PREVENT TAMPERING WITH METER CONTINUED WHEN SUSPICION PROVED JUSTIFIED UNDER TEST.—Expressing its opinion that a certain customer of the Union Electric Light & Power Company of St. Louis had used energy for which, because of meter tampering, no payment had been made, the Missouri Public Service Commission ordered, over the customer's protest, the continuance of the use of a lock box to cover his meter. This box had been installed twelve months previously to test the claim of irregularities made by the company, and the discrepancies between the readings in the following year and those for the six previous years were held by the commission to justify the company's distrust of the customer.

COMPETITION IDEA CONDEMNED IN OKLAHOMA.—The Oklahoma Corporation Commission has denied an application from John B. Nichols for a certificate of public convenience and necessity to sell natural gas and electrical energy in Chickasha. The commission found that no one had challenged the service of the Southwestern Light & Power Company in that city. Moreover, evidence showed that for some years prior to 1913 there had been two competing electric plants at Chickasha and that one of them went into a receivership and the other sold out on the basis of 50 cents on the dollar. The commission found that there is better electric service in Chickasha at this time than there was when two plants were operating there.

Recent Court Decisions

DUTY OF WARNING WHEN WIRES ARE STRUNG IN PLACES WHERE THEY ARE DANGEROUS.—Asserting that it is not sufficient to constitute a finding of negligence in an action for injuries that defendant knew of the particular danger which was the proximate cause of injury, the Court of Civil Appeals of Texas reversed a finding for the plaintiff in Pennington vs. West Texas Utilities Company. In this case a minor was killed while working on the roof of a house by a wire that the company was alleged to have strung across the privately owned lot on which the house was being built and of which no warning was given to the boy. Contradictory findings by the jury and the failure of the complaint to allege that the defendant had the duty to warn the victim, together with technical questions of improper presentation and argument in the trial court, brought an order from the superior tribunal for retrial. (11 S.W. [2d], 583.)*

ALLEGATION OF SPECIFIC NEGLIGENCE MAKES DOCTRINE OF "RES IPSA LOQUITUR" INAPPLICABLE.—In Orr vs. Des Moines Electric Light Company damages were sought for the death of a plumber who was killed apparently from shock while working in a dark place with an extension cord and lamp, electrical energy for lighting which came over the company's distribution system, supposedly at 110 or 120 volts. It was charged that the company negligently permitted its equipment to become defective and that the wire carried an excess voltage. The Supreme Court of Iowa reversed a verdict found in the lower court for the plaintiff on the ground that the specific allegation made was not proved and that, this specific allegation having been made, the principle of *res ipsa loquitur* ("the thing speaks for itself") could not be invoked. Two out of six judges dissented, holding that the allegations made of negligence by the company were general, not specific, in their nature and that therefore the law of *res ipsa loquitur* was applicable. (222 N. W. 560.)

ALLOCATION OF INVESTMENT AND COST IN COUNTY NOT ESSENTIAL TO CLAIM OF CONFISCATION BY STATUTE APPLYING TO THAT COUNTY.—In a suit brought by the Queens Borough Gas & Electric Company against the New York Public Service Commission (Prendergast *et al.*), the United States District Court for the Eastern District of New York overruled a contention that the company, which operates in more than one county, could not attack as confiscatory a statute regulating the maximum to be charged in one county because of failure of the company to allocate the plant investment and production cost in the county to which the statute applied, as opposed to such figures for its general business, inasmuch as the physical segregation of the company's plant with respect to each county was impossible, since a theoretical allocation of costs and values would be impracticable, and since the margin of confiscation was so great that no defensible allocation of costs and values between the two counties could change the result.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

Fred W. Insull Heads Southwestern Light & Power

Fred W. Insull of Tulsa was elected president and general manager of the Southwestern Light & Power Company at a meeting of directors of the company held recently in Oklahoma City. He succeeds Earl R. Ernsberger who resigned several weeks ago to devote his

F. W. Insull

entire attention to private business interests. Mr. Insull has been a vice-president of the Southwestern Light & Power Company and for several years he has been president of the Public Service Company of Oklahoma with headquarters at Tulsa. Both properties managed by Mr. Insull are subsidiaries of the Middle West Utilities Company of Chicago. He will continue to live in Tulsa and will handle the chief administrative duties of both companies. Headquarters of the Southwestern Light & Power Company, however, remain in Oklahoma City.

Mr. Insull has served two terms as president of the Oklahoma Utilities Association, 1922-1924. He has also served continuously as a member of the executive board of this association since 1920 and was formerly chairman of the electric light and power division of this association. He also is a member of the executive board of the Southwestern Geographic Division of the National Electric Light Association. Mr. Insull has been very active in state development. He is a past-president of the Tulsa Chamber of Commerce and at present is chairman of the industrial committee of that organization. He also is a member of the board of directors of the state chamber of commerce and is a director of the Tulsa Finance Corporation, an organization designed to sponsor the establishment of new industries in Oklahoma.

Señor M. Castellvi, consulting illumination engineer for the Barcelona Fair, who has been in this country for several weeks, consulting with engineers of the Westinghouse company on the illumination of the exhibition grounds of the World's Fair to be held this year in Barcelona, returned to Spain early in January.

F. W. Woodcock Heads New Utility Company

Floyd W. Woodcock, who as vice-president of Day & Zimmermann has been in charge of public utility properties under their management for eight years, has been named president of the Empire Public Service Corporation, formed recently, as a new holding company controlling properties in Maryland, Ohio, Kansas, Louisiana, Oklahoma, Texas and Colorado. Mr. Woodcock was connected with the public utility management department of Day & Zimmermann in Philadelphia. Later he was named acting general superintendent of the Martinsburg Power Company, Martinsburg, W. Va., and after a short association with that utility he was appointed general superintendent of the Eastern Shore Gas & Electric Company, Salisbury, Md. This position he held for four years, from 1916 to 1920. Mr. Woodcock is a member of the American Institute of Electrical Engineers, the American Electric Railway Association and other similar societies.

G. M. Gadsby Heads Utah Power & Light Company

George M. Gadsby, who recently became associated with the Electric Bond & Share Company of New York, as announced in the January 19 issue of the Electrical World, has been elected president and general manager of the Utah Power & Light Company, one of the subsidiaries of the Electric Bond & Share organization. Mr. Gadsby is succeeding D. C. Green, who was vice-president and general manager. Lafayette Hanchett, formerly president of the Utah Power & Light Company, becomes chairman of the board of directors. Before affiliating himself with the Electric Bond & Share interests Mr. Gadsby had spent more than ten years with the West Penn system in Pittsburgh.

William H. Snow, general manager of the New Bedford Gas & Edison Light Company, New Bedford, Mass., has resigned. David W. Beaman is now acting general manager.

Owen D. Young, chairman of the board of directors of the General Electric Company, sailed for Europe February 1 aboard the *Aquitania* to serve on the international committee for revision of German reparations, which will begin its meetings on February 9, in Paris.

A. B. Field Recipient of Lamme Medal

Allan B. Field, who has just been made the recipient of the Lamme medal by the Lamme medal committee of the American Institute of Electrical Engineers, is well known in engineering circles in this country, although he has been identified with British electrical

A. B. Field

activities since 1914. For more than ten years he has been connected with the Vickers interests, at first with Vickers, Ltd., in London and since 1920 with the Metropolitan-Vickers Electrical Company, Ltd., Manchester, in the capacity of consulting engineer.

From 1899 to 1902 Mr. Field was engaged in engineering work in traction, power and lighting projects with the British Thomson-Houston Company in London. In order to become more familiar with American practice he joined the General Electric Company in 1902 and spent more than a year in the testing department in Schenectady, afterward being engaged in transformer design. From January, 1905, to October, 1908, he was employed by the Bullock Electric Manufacturing Company and the Allis-Chalmers Company in the design of alternating-current generators and motors. He joined the engineering forces of the Westinghouse Electric & Manufacturing Company in 1909 and was responsible for the development and commercial introduction of the built-up rotor design, which has ever since been followed by that company. He spent three years as consulting engineer and professor of mechanical engineering at the University of Manchester before becoming identified with the Vickers interests.

Mr. Field is a fellow of the American Institute of Electrical Engineers and a member of the American Society of Mechanical Engineers, the Institution of Electrical Engineers (Great Britain) and Institution of Mechanical Engineers (Great Britain).

T. N. Jones in Richmond

T. Norman Jones, for many years general manager of the Virginia Electric & Power Company, Norfolk, has been appointed executive vice-president of the company, with headquarters in Richmond. He assumed his new duties February 1. Mr. Jones has been actively identified with the Virginia utility since 1906, when he entered its employ as mechanical and electrical engineer. One year later he joined the Richmond & Chesapeake Bay Railway, the electric interurban line between Richmond and Ashland, but he returned to the Virginia Railway & Power Company a few

T. N. Jones

years later as chief superintendent of railways. Early in 1916 Mr. Jones was appointed assistant general manager of the company's properties at Norfolk, subsequently being made general manager, the position he occupied until his recent promotion.

Mr. Jones was born in Virginia and was educated at the University of Virginia. He was associated with the McKay Engineering Company and the United Electric Light & Power Company of Baltimore before he entered the employ of the Virginia Electric & Power Company.

RALPH D. CUTLER, sales manager of the Hartford Electric Light Company, has been elected a vice-president of that organization. Mr. Cutler has been identified with commercial development and sales policy formulation in the Hartford utility for nearly two decades.

VIGGO E. BIRD, formerly vice-president and general manager of the Connecticut Power Company, with headquarters at New London, has been elected executive vice-president of the Hartford Electric Light Company.

EDGAR H. BRISTOL, president of the Foxboro Company, Foxboro, Mass., sailed from New York City on the S.S. *Santa Teresa* January 31 for an extensive tour through South America.

CLYDE J. HOLMES, general counsel of the Consumers Power Company, Jackson, Mich., has been elected a vice-president and a director to succeed W. W. Tefft, resigned. Mr. Holmes has been with Consumers Power Company since its conception and prior to that time he had been actively engaged as an attorney in Grand Rapids in association with the late W. A. Foote, in the development of water power and the transmission system which was to be the backbone of the present Consumers Power Company. Mr. Holmes participated in the problems having to do with the organization of the Consumers Company and subsequently removed to Jackson to take over the legal department.

EDGAR A. FELDTKELLER has been appointed vice-president in charge of operation of the Empire Public Service Corporation, recently incorporated to furnish electric light and power to certain communities in Maryland, Ohio, Kansas, Louisiana, Oklahoma, Texas and Colorado. Mr. Feldtkeller has a background of experience in the public utility field, having been connected with the Milwaukee Electric Railway & Light Company, the Commonwealth Power Company, the Alexandria County Lighting Company and, more recently, as manager of the Florida division of the General Engineering & Management Corporation.

A. D. Colvin Appointed to New Executive Position

A. D. Colvin, formerly general manager of the Hartford Electric Light Company, has been elected executive vice-president of the Connecticut Power Company with headquarters in New London, to succeed Viggo E. Bird, who has removed to Hartford. Mr. Colvin has been identified with the Hartford Electric Light Company since 1911 as assistant to the general manager. After serving ten years with this utility, he was named general manager, the position he occupied until his recent appointment as executive vice-president of the Connecticut Power Company.

Mr. Colvin was born in Troy, N. Y., and was graduated from the Rensselaer Polytechnic Institute in 1906. His first connection after leaving college was as personal assistant to Dr. W. L. Robb, consulting engineer of Troy. From 1907 to 1909 he was assistant superintendent of the electrical department of the Troy Gas Company. Previous to affiliating himself with the Hartford utility he served for two years as assistant in physics and electrical engineering at

A. D. Colvin

the Rensselaer Institute. Mr. Colvin is a director of the Turners Falls Power & Electric Company, Turners Falls, Mass.; the Hartford Electric Light Company, Hartford, Conn., and the Union Electric Light & Power Company, Unionville, Conn.

Obituary

Harold B. Whiteman

Harold B. Whiteman, assistant to the vice-president of the Allied Power & Light Corporation, died at his home in New York, February 1 as a result of pneumonia. In the course of his career Mr. Whiteman had given considerable attention to operating problems of various utilities in Michigan, Ohio, Indiana and Illinois. Starting with the Columbus (Ohio) Railway, Light & Power Company in the railway department, he subsequently removed to Chattanooga and spent a year with the local utility. Later he removed to East St. Louis, Ill., and then to Nashville. In 1917 he became assistant general superintendent of the Chattanooga Railway & Light Company and three years later was made assistant general superintendent of the Tennessee Power Company. This position he retained with the Tennessee Electric Power Company upon its organization in the summer of 1922. In 1924 he became commercial manager. He was then called to New York to assume executive duties with Hodenpyl, Hardy & Company, which organization last year was taken over by the Allied Power & Light Corporation.

JOHN M. KINGSLEY, for the past three years New England sales manager of the Square D Company, with headquarters at Boston, died January 28 at Brighton, Mass. He was born at Rutland, Vt., 33 years ago, and his career included connections with the Western Electric Company, Inc., Chicago; the Northern Electric Company, Montreal, and the Square D Company in Detroit.

JESSE L. JONES, chief chemist of the Westinghouse Electric & Manufacturing Company, died January 21 at Green Cove Springs, Fla., in his sixty-third year. Mr. Jones was born at Martin's Ferry, Ohio, and was graduated from Ohio State University in 1890. After being employed as assistant state chemist of Ohio, head of the testing department of William Cramp & Sons, shipbuilders, Philadelphia, and in several other positions, he entered the employ of the Westinghouse company in 1902.

Financial and Statistical News

Firmness Is Predicted in Money Market

Utility Stocks Have Made Some Substantial Gains During the Week, but Recessions Have Dominated

APART from the relative ease of money at the moment, January developments emphasize the firmness of money conditions, according to a current bulletin of the Harvard Economic Society. Notwithstanding the recovery in the Federal Reserve ratio and the drop in member bank rediscounts, which factors are cited by some as an indication of relief in the credit situation, the authority referred to regards the situation from a slightly different angle, as indicated in the following: "The prospect is clearly for continued firmness. As long as an increasing volume of credit is devoted to speculative purposes, continuance of a firm money policy by the reserve authorities is probable. This policy in the past month has taken the form of conservatism in the purchase of acceptances and has lately been reflected in a considerable reduction of the acceptance holdings of the system. In part this is a seasonal movement, offset by the return of currency from circulation, but its influence is on the side of firmer money, since it takes reserve funds from the market."

While some of the power and light stocks have shown further market gains during the week, others have lost a good part of the gain made in the upward swing of the previous week. This latter category includes American Superpower A and B, American Gas & Electric, Southeastern Power & Light, Electric Bond & Share Securities, Electric Investors and numerous other issues.

Recent Listings

The New York Stock Exchange has authorized listing of 50,000 additional shares of $6 preferred stock of the American & Foreign Power Company without par value on official notice of issuance in exchange for securities of subsidiary companies and for a cash consideration, making the total amount of $6 preferred stock applied for 199,310 shares. There has also been authorized the listing of 35,805 shares of common stock without par value of the American Water Works & Electric Company on official notice of issuance as a stock dividend, making the total amount applied for 1,486,897 shares. There were also authorized 92,993 additional shares of class A common stock of the Louisville Gas & Electric Company upon official notice of issuance and payment in full, making the total amount applied for not to exceed 619,273 shares of class A common.

Electrical securities have also been authorized for listing on outside exchanges, as follows:

The Philadelphia Stock Exchange has approved for listing 480,000 shares of preferred stock, $25 par value of the Philadelphia Electric Power Company.

The Pittsburgh Stock Exchange has approved for listing 296,252 additional shares of common stock, par $50, of the Westinghouse Electric & Manufacturing Company. Upon the issuance of this additional stock the outstanding capitalization will consist of 2,586,341 shares of common stock and 79,974 shares of preferred stock, each having a par value of $50.

German General Electric Reports Profits

The German General Electric Company (Allgemeine Elektrizitäts Gesellschaft) reports profits of 16,502,975 marks (approximately $4,000,000) for the year ended September, 1928, after setting aside extensive depreciation charges and 2,000,000 marks for the social welfare work of the company. The turnover during the year was more than 500,000,000 marks (about $120,000,000). There were unfilled orders totaling 385,000,000 marks.

German Companies Float New Loans

Six per cent sinking fund gold debentures of the Prussian Electric Company (Preussische Elektrizitäts-Aktiengesellschaft) have been offered to the amount of $4,000,000 at 91 and interest to yield 6.75 per cent. These securities, dated February 1, 1929, and maturing February 1, 1954, will be the direct obligations of the company.

The Unterelbe Power & Light Company (Elektricitätswerk Unterelbe, Aktiengesellschaft) made an offering of two-year 6 per cent gold notes priced at 99 and interest, yielding over 6½ per cent. These notes were dated February 1, 1929, and mature February 1, 1931.

Buffalo, Niagara & Eastern Merger Approved

Stockholders of the Buffalo, Niagara & Eastern Power Corporation have approved of the consolidation of the company and its subsidiaries to form the Niagara Power Corporation. Provision was made for the exchange of each Buffalo, Niagara & Eastern common share for 1¼ shares of Niagara Power Corporation. The Niagara Falls Power Company stockholders, one of the subsidiaries to be merged, will receive one common and one preferred in the new company for each common share held.

Utilities Power & Light Changes Set-up

The stockholders of the Utilities Power & Light Corporation at a meeting held at Richmond voted to increase the authorized capital to $1,030,000,000. The corporation's present capital, as assessed for taxation, is $230,000,000, consisting of 300,000 shares of 7 per cent cumulative preferred stock of $100 par value, 1,000,000 shares of no-par value class A stock and 1,000,000 shares of class B no-par value stock. The change would increase the number of shares of the class A and class B stock to 5,000,000 shares each.

The Utilities Power & Light Corporation was charted in Virginia on March 9, 1915, as the Utilities Development Corporation, and its name was changed on May 2, 1922, to the present one. Officers of the company include H. L. Clarke of Chicago, president and treasurer; J. N. Canavan and W. C. Van Allen, also of Chicago, and H. C. Orton of Dubuque, Iowa, vice-presidents.

Public Service of New Jersey Increases Dividend

A quarterly dividend of 65 cents has been declared on the common stock of the Public Service Corporation of New Jersey and the regular dividends on the 8 and 7 per cent and $5 cumulative preferred stock, payable March 30, 1929, to holders of record March 1, 1929. Also regular monthly dividends for February and March were declared on the 6 per cent cumulative preferred stock. From December, 1926, to December, 1928, inclusive the corporation paid regular quarterly dividends of 50 cents per share on the common stock, and in addition on December 31, 1928, paid an extra dividend of 40 cents per share.

American Water Works Power Output Gains

Power output of the American Water Works & Electric Company's electric properties for December was 153,374,890 kw.-hr., as compared with 143,633,998 for the similar month of 1927, an increase of 7 per cent. Output for the twelve months ended December 31, 1928, was 1,763,468,095 kw.-hr., against 1,650,916,979 for the previous year, a gain of 7 per cent.

North Boston Growing

The North Boston Lighting Properties' total assets at the close of 1928 were $31,203,143, compared with $24,443,131 at December 31, 1927, and the net earnings per common share after 6

per cent preferred dividends were $2.26 for 1928, against $2.42 in 1927, according to figures released by D. E. Manson, vice-president. There are now 373,224 common shares (no par) outstanding. Dividends received from the underlying companies totaled $1,611,712 in 1928, against $1,498,592 in the previous year. During the year the Gloucester (Mass.) Electric Company was added to this group, which is under the management of Charles H. Tenney & Company, Boston. Common stock subscription rights, in which preferred stockholders participate, will be issued within a few weeks.

Baltimore Utility Earns $5.49 a Share

The Consolidated Gas, Electric Light & Power Company of Baltimore last year earned $5.49 on its common stock, against $4.62 a share in 1927, according to a statement filed with the Public Service Commission of Maryland. During the year $2,139,770 was charged directly against corporate surplus, the principal item being $1,850,000 premium paid to retire 8 per cent, 7 per cent and 6½ per cent preferred stocks, for which 5 per cent preferred stock was substituted. This operation resulted in a net increase in the corporate surplus of $217,106.

Winnipeg Output Increased 28 per Cent

During the year 1928 the Winnipeg Electric Company and its associates, the Manitoba Power Company, had a total output of 654,900,700 kw.-hr., this figure representing an increase of 28 per cent over the year previous, and a peak load on the system of 130,500 kw. The Great Falls plant of the Manitoba Power Company has now been completed by the installation of the fifth and sixth units, and the increased load in prospect has obliged the company to proceed with construction at its new site at the Seven Sisters Falls on the Winnipeg River, where an ultimate capacity of 220,000 hp. will be developed.

Allis-Chalmers Earned $11.28 in 1928

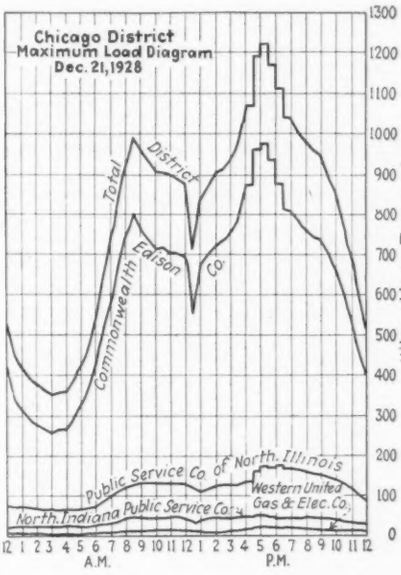
The earnings per share on the common stock of the Allis-Chalmers Manufacturing Company amounted to $11.28 in 1928, which is the only class of stock now outstanding, the preferred having been retired July 1, 1927, comparing with $10.02 per share in 1927. The net profits shown in the accompanying table are after debenture interest for 1928 and after preferred dividends and debenture interest applicable to 1927, and for both years after provision for federal income taxes.

Bookings in 1928 aggregated $35,957,197, contrasted with $30,651,807 in 1927, an increase of 17.31 per cent. Unfilled orders on hand December 31, 1928, amounted to $9,681,214.

1,221,500-Kw. Peak in Chicago District

A new record maximum demand of 1,221,500 kw. was established for the Chicago district on Friday, December 21, 1928. This is an increase of 132,600 kw., or 12 per cent, over the previous year.

It so happened that the shortest day of the year was also dark and cold, consequently the railway heating load superimposed on all other loads caused a particularly high demand on the system.



The territorial loads of the Commonwealth Edison Company and the neighboring companies with which it interchanges energy are shown in the accompanying chart, which also gives the total load for the Chicago district.

ELMIRA UTILITY INCREASES CAPITAL STOCK.—The Elmira Water, Light & Railroad Company has filed notice with the Secretary of State of an increase of capital from $4,096,200 to $6,200,000.

Allis-Chalmers Manufacturing Company Comparative Quarterly Earnings

	Billings		Net Profit Available for Common Stock Dividends	
	1928	1927	1928	1927
First quarter	$8,415,253	$7,906,355	$675,600	$561,460
Second quarter	8,979,358	8,666,873	804,407	543,237
Third quarter	9,337,924	8,479,653	743,623	776,709
Fourth quarter	9,562,024	8,299,369	710,278	723,613
Total twelve months	$36,294,561	$33,352,252	$2,933,909	$2,605,019

International Paper & Power Doubles Energy Output

The production of electric energy in 1928 by the International Paper & Power Company system was 3,504,131,000 kw.-hr., practically double the output of the system for the previous year, 1927. For the month of December, 1928, output of the International Paper & Power Company was 355,978,000 kw.-hr., an increase of 53 per cent over the production of the system in December, 1927. Included in the output figures are those of the New England Power Association, Canadian Hydro-Electric Corporation, Ltd.—controlling the Gatineau Power Company and Saint John River Power Company—the Deer Lake (Newfoundland) plant of the International Power & Paper Company of Newfoundland, Ltd., and the hydro-electric plants of the International Paper Company group.

Utility Financing Active

Several substantial offerings of new securities were made by the electric light and power companies of the country during the first week of February. First refunding mortgage sinking fund gold bonds of the Consolidated Gas, Electric Light & Power Company of Baltimore were offered to the amount of $10,500,000 at 100 and accrued interest, yielding 4¾ per cent. These series G bonds were dated March 1, 1929, and mature March 1, 1969. The proceeds, together with additional cash to be supplied by the company, will be used to refund $10,265,000 first refunding mortgage bonds, series A, 6 per cent, which have been called for redemption at 105 on April 5, 1929, thereby decreasing bond interest charges by $128,312 per annum, and to reimburse the company, in part, for cost of property additions and extensions.

The Central Public Service Corporation made an offering of 5½ per cent convertible gold debentures at 96½ and interest, yielding about 5.80 per cent, a piece of financing involving a total of $25,000,000. These debentures will be convertible at the holders' option subject to certain restrictions into $6 cumulative preferred stock at the rate of ten shares of preferred stock for each $1,000 principal amount of debentures. Proceeds from the sale of these debentures will be used in connection with the acquisition or retirement of funded debt of the corporation, funded debt and preferred stocks of subsidiaries and bank loans of the corporation.

First mortgage 6 per cent gold bonds, series A, of the Texas-Louisiana Power Company were issued at 99½ and interest to yield over 6 per cent, a piece of financing involving $3,000,000. Proceeds of this financing will be used to reimburse the company for construction expenditures, to retire existing equipment obligations, for the acquisition of additional properties and for other corporate purposes.

The North American Gas & Electric

Current Earnings Reports of Electric Light and Power Companies

	1928	1927	Per Cent Increase	Operating Ratio 1928	Operating Ratio 1927
American Water Works & Electric & Subs. (Year ended Nov. 30)					
Gross earnings	$50,822,123	$48,706,743	4.3	51	53
Net earnings	24,716,558	23,045,487	7.3	..	..
Blackstone Valley Gas & Elec. & Subs. (Year ended Dec. 31)					
Gross earnings	6,080,153	5,910,629	2.9	60	64
Net earnings	2,387,577	2,123,205	12.5	..	..
Carolina Power & Light (Year ended Nov. 30)					
Gross earnings	8,996,415	8,900,700	1.0	48	53
Net earnings	4,602,199	4,151,840	11.0	..	..
Cities Service (Year ended Dec. 31)					
Gross earnings	34,744,597	33,061,062	5.1	..	..
Net earnings	33,584,465	31,952,952	5.1	..	..
Commonwealth Power (Year ended Dec. 31)					
Gross earnings	58,504,122	53,172,977	10.0	51	53
Net earnings	28,440,059	24,741,603	14.9	..	..
Consumers Power (Year ended Dec. 31)					
Gross earnings	30,464,127	26,612,449	14.5	49	51
Net earnings	15,430,230	12,889,384	19.7	..	..
Detroit Edison (Year ended Dec. 31)					
Gross earnings	52,366,335	47,379,779	10.5	65	68
Net earnings	18,264,814	15,223,804	12.0	..	..
Eastern Texas Electric & Subs. (Year ended Dec. 31)					
Gross earnings	8,025,087	7,214,132	11.2	59	64
Net earnings	3,262,564	2,613,107	24.8	..	..
Engineers Pub. Service & Subs. (Year ended Dec. 31)					
Gross earnings	32,864,658	29,453,595	11.5	58	62
Net earnings	13,861,200	11,346,336	22.2	..	..
Federal Light & Traction & Subs. (Year ended Nov. 30)					
Gross earnings	7,843,650	6,962,554	12.7	60	61
Net earnings	3,168,757	2,676,319	18.4	..	..

	1928	1927	Per Cent Increase	Operating Ratio 1928	Operating Ratio 1927
Galveston-Houston Electric & Subs. (Year ended Dec. 31)					
Gross earnings	$5,248,417	$5,052,638	3.9	68	68
Net earnings	1,704,959	1,573,117	8.3	..	..
General Gas & Electric & Subs. (Year ended Dec. 31)					
Gross earnings	23,498,285	24,546,184	—4.2	52	55
Net earnings	11,338,018	11,077,897	2.4	..	..
Metropolitan Edison & Subs. (Year ended Dec. 31)					
Gross earnings	11,250,386	10,331,124	8.9	57	58
Net earnings	4,835,010	4,336,552	11.5	..	..
Penn-Ohio Edison & Northern Ohio Power (Year ended Dec. 31)					
Gross earnings	27,725,092	26,379,486	5.1	60	65
Net earnings	10,990,544	9,418,775	16.7	..	..
Portland Electric Power (Year ended Dec. 31)					
Gross earnings	12,526,241	12,154,452	3.1	59	59
Net earnings	5,039,318	4,961,770	1.6	..	..
Puget Sound Power & Light & Subs. (Year ended Dec. 31)					
Gross earnings	15,141,396	14,925,482	1.4	55	57
Net earnings	6,682,246	6,360,815	5.0	..	..
Tennessee Electric Power (Year ended Dec. 31)					
Gross earnings	13,453,843	12,515,760	7.5	52	54
Net earnings	6,488,490	5,743,393	13.0	..	..
Texas Power & Light (Year ended Nov. 30)					
Gross earnings	9,711,589	9,433,144	3.0	53	55
Net earnings	4,590,944	4,211,689	9.0	..	..
Utah Power & Light (Year ended Nov. 30)					
Gross earnings	10,992,167	10,646,581	3.0	49	48
Net earnings	5,664,256	5,532,381	2.0	..	..

Company issued 65,000 shares of class A stock ($1.60 dividend series), the price being $24.50 per share.

First mortgage 5 per cent gold bonds, series A, of the Tide Water Power Company were offered to the amount of $5,300,000 at 94½ and accrued interest, to yield about 5.35 per cent.

Bond and Share Merger Rumor Persists

Asked for a statement concerning rumors of an impending merger of a group of companies associated with the Electric Bond & Share Corporation, representatives of that organization stated that no information was available. Rumors persist that plans are under way not only to unite Electric Bond & Share with Electric Bond & Share Securities Corporation, but that the plans also include simplification of structures of various holding companies under Bond & Share supervision.

For some time it has been rumored that plans were under way for the unification of National Power & Light and Electric Power & Light. American Power & Light has also been associated with the proposed union in Wall Street comment. Electric Bond & Share has substantial minority holdings in these three companies, and the suggested procedure is an exchange of stock between the three.

Gross earnings of the three holding companies with subsidiaries for 1927 amounted to around $155,000,000. A union of these would produce the second largest utility system in the country.

HARTFORD UTILITY ADDS TO DIRECTORATE.—Frank Cheney, Jr., chairman of Cheney Brothers, South Manchester, Conn., has been elected a member of the board of directors of the Hartford Electric Light Company, and A. D. Colvin, executive vice-president of the Connecticut Power Company, has also been added to the directorate of the Hartford company.

CONNECTICUT POWER ADDS TO DIRECTORATE.—Viggo E. Bird, executive vice-president of the Hartford Electric Light Company, and Charles G. Bill, president of the Union Electric Light & Power Company, Unionville, Conn., have been elected members of the board of directors of the Connecticut Power Company.

SAN DIEGO UTILITY OFFERS RIGHTS TO SHAREHOLDERS.—The San Diego Consolidated Gas & Electric Company is planning to offer its common-stock holders rights to subscribe for new common shares at $100 par to an amount not exceeding $3,000,000, which amount the California Railroad Commission has authorized the company to sell. Proceeds are to be used for betterments to plant and extensions.

DETROIT EDISON STOCK ISSUE APPROVED.—Stockholders of the Detroit Edison Company at a meeting held February 4 approved an increase in the authorized capital stock from $120,000,000 to $150,000,000. The stock is of $100 par value.

Electric Light and Power Plants in Arkansas

The Department of Commerce announces that according to returns received at the quinquennial census of electric industries taken in 1928 the generator capacity of electric light and power plants in Arkansas increased from 42,239 kw. to 86,655 kw., or 105.2 per cent, during the period from 1922 to 1927. Marked increases are shown also for the horsepower of steam turbines, internal-combustion engines and hydro-turbines in use as prime movers.

The table above gives a summary for 1927 (preliminary figures, subject to revision) in comparison with 1922.

	1927	1922	Per Cent of Increase
Number of establishments, total	41	87	†
Commercial	28	63	†
Municipal	13	24	†
Prime movers:			
Total number	200	166	20.5
Total horsepower	131,044	57,130	129.4
Steam engines:			
Number	64	95	†
Horsepower	18,904	17,639	7.2
Steam turbines:			
Number	52	26	†
Horsepower	87,637	35,665	145.7
Internal-combustion engines:			
Number	76	42	†
Horsepower	10,483	2,986	251.1
Hydro-turbines:			
Number	8	3	†
Horsepower	14,020	840	1,569.0
Generators:			
Number	168	170	*1.2
Kilowatt capacity	86,655	42,239	105.2
Output of stations, kw.-hr.	174,197,548	84,469,023	106.2
Number of customers	115,279	56,096	105.5

*Decrease.
†Per cent not computed where base is less than 100.

Business News and Market Conditions

Promote Use of Armored Cable

In a recent announcement A. Penn Denton, engineering director of the armored conductor and flexible metallic conduit section of the National Electrical Manufacturers' Association, states that the section, as a manufacturing group, recognizes the broad field of use for armored conductors in residential, industrial, commercial and farm wiring. "With this in mind," says Mr. Denton, "it has engaged in a trade extension program which contemplates constant research and development in conduit and fittings.

"The armored cable industry has grown from an infant industry 25 years ago to its present prominent position as a leader in the manufacturing wiring field. The industry, through co-operative effort, expects to extend the use of armored conductors in all wiring fields. The section believes that the trend in wiring practice today, as given in the National Electrical Code, is toward standardization in all types of wiring in all cities of the country.

"This program is resulting in economies in manufacturing, distribution and installation methods, all of which are in the public interest."

Electric Heating Exposition

An exposition of industrial electrical appliances which has just been held in Manchester, England, incorporated a wide range of apparatus from electric glue pots to 180-kw. induction furnace equipment and from domestic heaters to welding sets. Electric furnaces were prominent, being demonstrated by seven exhibitors.

Copper Advances ¾ Cent—Lead Up a Tenth

Price advances for copper, lead and tin have featured the non-ferrous metal markets of the past week. Zinc is firm and any well-defined buying movement will undoubtedly bring higher prices.

NEW YORK METAL MARKET PRICES

	Jan 30, 1929 Cents per Pound	Feb. 6, 1929 Cents per Pound
Copper, electrolytic	17	17.75
Lead, Am. S. & R. price	6.65	6.75
Antimony	9.50	9.75
Nickel, ingot	35	35
Zinc, spot	6.70	6.70
Tin, Straits	48.625	49.875
Aluminum, 99 per cent.	24.30	24.30

Base copper wire price Feb. 6, 1929, 19¾ cents.

Three advances in the price of copper during the last week were needed to satisfy the seemingly insatiable appetite of consumers. The latest advance was from 17½ cents to 17¾ cents per pound, delivered Connecticut, and sales at the higher level have been virtually non-existent, so it would appear that the buying ardor may be curbed temporarily. Fabricators apparently are anticipating a pinch in supplies, as the major demand continues for forward deliveries, May being the favored month the past week, though considerable June metal has also been sold. Foreign demand continues at a high rate, though at least one producer has temporarily withdrawn from this market in order to continue taking his proportion of the domestic business.

Value of Electrical Imports Almost $3,000,000

Almost $3,000,000 worth of electrical equipment was imported into the United States during 1928, according to figures just released by the Bureau of Foreign and Domestic Commerce. The total was $2,789,994. Details by quarters and by country of origin follow:

Canadian Power Group to Spend Fifty Millions

Aggregate expenditures exceeding $50,000,000 are provided for in development programs announced by the various companies constituting the Power Corporation of Canada. The group includes controlled companies as well as those in which the holding company has part interest.

The outlay includes the new hydro development at Bridge River, $15,000,000, and at Lower Stave River, at Ruskin, $8,000,000; at Prince Rupert and Stewart, B. C., which the Power Corporation recently purchased, $1,500,000; Northwestern Power Company's development at Seven Sisters Falls, $13,000,00; Montreal Island Power Company's development on Back River, $10,000,000; East Kootenay Power, $1,000,000, and several others, including Bathurst Power & Paper Company, which soon will install another unit at one of its important properties.

Imports of Electrical Apparatus Into the United States

Article	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Carbon-filament incandescent electric lamps:				
Miniature	$64,450	$116,600	$233,146	$284,074
Other lamps	79,492	94,872	84,468	120,363
Metal-filament incandescent electric lamps:				
Miniature	3,053	10,501	15,366	19,009
Other lamps	24,052	29,687	8,689	32,094
Other electric lamps, including neon, etc.	482	2,238	5,241	6,795
Generators	77	.....	.....	.....
Transformers	757	.....	.....	153
Converters, double-current and motor-generators, dynamotors and other converting apparatus	.....	.....	.....	.....
Switches, circuit breakers, fuses, choke coils, reactors, sockets, plugs, etc.	491	1,197	37	1,001
Motors, stationary, railway, vehicle, automotive, and other	112	461	26,377	1,069
Electric fans and blowers	262	955	1,041	.....
Table household, kitchen and hospital utensils and similar hollow or flat ware containing electrical heating element:				
Electric flatirons	6	4	227	104
Aluminum	.....	.....	.....	358
Iron or steel-enameled or glazed with vitreous glasses	653	181	193	6,926
Copper, brass, steel or other base metal	300	272	418	199
Industrial electric furnaces and ovens	.....	86	68	3,398
Therapeutic apparatus and X-ray machines	6,331	1,313	1,930	4,316
Radio and wireless apparatus and parts	51,904	49,296	40,332	40,267
Telegraph apparatus	1,076	1,811	888	915
Telephone apparatus	1,337	360	171	535
Spark plugs	125	.....	.....	.....
Storage batteries and parts	2,934	5,252	977	9,364
Batteries other than storage	1,363	837	970	809
Electrical machinery and parts	207,543	115,240	190,447	163,229
Electric apparatus and parts	81,169	203,835	142,286	178,780
Total	$527,844	$635,123	$753,272	$873,755

COUNTRY OF ORIGIN

Country	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Austria	$8,283	$15,466	$11,308	$43,014
Australia	3,784	.....	.....	145
Azores and Madeira Islands	.....	.....	.....	.....
Belgium	21	510	1,340	4,092
Brazil	18	.....	12	.....
British Honduras	10	.....	.....	.....
British West Indies	.....	.....	.....	.....
Canada	5,991	4,410	9,464	5,157
Ceylon	.....	.....	.....	.....
China	3,486	2,426	.....	.....
Cuba	247	12	13	.....
Czechoslovakia	1,354	2,447	19,472	4,165
Denmark	53	4,923	.....	237
France	11,863	9,426	19,788	26,524
French Oceania	.....	.....	.....	.....
Germany	163,975	111,426	95,956	172,522
Gibraltar	.....	.....	20	.....
Hungary	.....	.....	.....	.....

Country	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Irish Free State	.....	.....	.....	.....
Italy	$2,932	$120	$314	$341
Japan	90,429	204,285	305,071	348,064
Mexico	100	.....	50	.....
Netherlands	2,744	438	1,021	5,082
Norway	525	175	.....	427
Panama	.....	15	.....	250
Philippine Islands	.....	.....	.....	.....
Poland and Danzig	.....	.....	4	.....
Portugal	6	.....	.....	.....
Rumania	.....	.....	.....	.....
Spain	.....	.....	13	.....
Sweden	119,328	183,476	121,043	181,002
Switzerland	54,381	47,772	120,184	33,457
United Kingdom	58,314	47,796	48,199	49,276
Total	$527,844	$635,123	$753,272	$873,755

Market Conditions

EVIDENCE accumulates that January's total business in electrical equipment considerably exceeded that of the same month last year. February has opened with volume satisfactory and the outlook decidedly good. In this week's records power company requirements again appear more prominent than those of manufacturing industries.

Scheduled materials for power company use lead in New England, while the industrial field is responsible for the largest volume in the Eastern district. In the Southeast inquiries are numerous, but orders are rather limited at the moment.

As previously intimated, substantial business is originating from the railroads in the Middle West. Power company orders recorded this week are less substantial. In the St. Louis district lead mining is providing a fair number of small orders.

Power company business on the Pacific Coast is exceedingly active and many branches of industry are providing substantial orders. The West Coast seems to be the most active section of the country at the moment.

Orders Small But Inquiries Numerous in Southeast

Inquiries, rather than orders, continue to be the case in the Southeast, though a reasonably satisfactory volume of orders is coming through. A central station in Georgia ordered 120,000 lb. of bare and weatherproof copper, while a company in Alabama ordered the same material to the extent of 110,000 lb. A North Carolina company purchased 100,000 lb. of bare and weatherproof copper and another power company ordered $2,750 worth of cable. One of the larger companies' distribution and small power transformer purchases aggregated $4,800, while its pole orders totaled $3,600. Another central-station order was for insulators amounting to $3,150. One of the larger companies is in the market for arrester equipment amounting to $15,000 and one carload of pole line hardware and orders will probably be placed during the week.

Industrial buying is slow, but there is a satisfactory amount of business pending. A new cotton bag mill in Alabama will order motor, transformer and switching equipment aggregating $100,000 and wiring supplies amounting to $20,000. A rayon plant in Georgia will order three carloads of rubber-covered and lead-sheathed cable, switching equipment and miscellaneous electric equipment totaling $50,000. A cotton mill in Georgia has asked for bids on loom motor equipment which will cost $4,000. A town in Georgia ordered equipment for a 56-standard white-way system. The Georgia Power Company has purchased the municipal electric distribution system in Stockbridge, Ga., and will construct a transmission line. Construction projects are as follows:

The Chevrolet Motor Company, Detroit, plans an assembling plant at Richmond, Va., to cost $300,000. The Monongahela West Penn Public Service Company, Fairmont, W. Va., plans an equipment storage and distributing plant, with mechanical facilities, at Clarksburg, W. Va., to cost $45,000. The East Coast Utilities Corporation, Chicago, plans a hydro-electric plant on the French Broad River, near Marshall, N. C., to cost $200,000. The Golding Keene Company, Keene, N. H., contemplates a feldspar grinding mill at Toecane, N. C., to cost $75,000. The South Carolina Power Company, Charleston, S. C., contemplates extensions in transmission lines and will build substations at Allendale, St. George and Blackville, S. C. The Birmingham Electric Company, Birmingham, Ala., plans an expansion and improvement program, including transmission lines and power substations to cost $1,000,000.

Power Equipment Sales Lead in New England

Turbo-generator sales involving about $100,000 lead in heavy equipment awards in the New England district. Small motor sales continue to show strong demands and switch and control and scheduled equipment sales are active. Many orders for materials and supplies for new automatic control substations will soon be placed. Two orders of interest for turbo-generators are one 10,000-kw unit, amounting to $30,000, for southern New England and one 30,000-kw unit for eastern Massachusetts. Small motors are in good demand and machine tool manufacturers are in the market. The total sales of motors for one manufacturer reached over $50,000. Scheduled materials are maintaining a good volume in sales and orders are being received for new equipment for several automatic substations. Inquiries for a wide range of equipment, with power generation and transmission line supplies most marked, are receiving attention. Small industrial plant expansion is noticeably encouraging. Construction projects are as follows:

Scott & Williams, Inc., Laconia, N. H., plan an addition to its knitting machinery plant to cost $120,000. The Wright & Corson Company, Milford, Conn., plans an addition to its rivet and stud manufacturing plant to cost $350,000. The Pratt & Whitney Aircraft Company, Hartford, Conn., will build a plant at Longueuil, Que., to cost $85,000. The Arrow Electric Company, Hartford, Conn., plans an addition to cost $100,000.

Industrial Business Holds Strong in Eastern District

The demand for electrical equipment for industrial service continues active in the Eastern district and there is a strong undertone in the increasing volume of inquiries for motors, control apparatus and affiliated equipment. An aircraft manufacturer in northern New York has placed a contract for a quantity of dynamometers and affiliated equipment to cost $100,000. A sulphur company in Texas has ordered a turbine unit from a New York maker to cost $30,000. A New York copper company operating in Utah is in the market for a heavy commitment of motors. Another copper company in Arizona has purchased four 200-hp. motors from a Pennsylvania manufacturer. Steel mills are showing interest in heavy-duty motors of high rating and sizable transactions are anticipated in this line.

Power station business is following the trend of industrial account and the outlook is good for commitments for early spring delivery. A central station in Texas has ordered a turbo-generator unit from a New York maker to cost $375,000. A power company in northern New York has contracted for a quantity of transformers, frequency-changer set and miscellaneous apparatus to an amount of $525,000. A feature of the week's news is the transmission line program of the Public Service Electric & Gas Company for 1929, covering a double-circuit steel tower line from Metuchen to Trenton, N. J., to cost $3,000,000, and a single-circuit steel tower line from Roseland to a point near Lambertville, N. J., to cost close to a like sum.

A leading maker of marine equipment reports continued encouraging business, with inquiries indicating early future contracts. An order has been received for apparatus for a private vessel to cost $275,000. Wire and cable demand shows little change, but there is an improved call for paper-wound material from central stations. Lighting equipment continues on a satisfactory basis, with street-lighting installations showing promise for better volume within 30 to 60 days. Construction projects are as follows:

The National Biscuit Company, New York, will build a paper carton plant at Beacon, N. Y., to cost $175,000. The Asiatic Petroleum Company, New York, plans a unit at its storage and distributing plant at Tampa, Fla., including power plant to cost $230,000. The Ferndale Farms, Inc., Brooklyn, plan a milk plant to cost $110,000. The Royal Baking Powder Company, New York, plans a branch factory in South Africa, to cost $250,000. The National Lime, Cement & By-Products

Corporation, Buffalo, plans a lime manufacturing plant at Tuscumbia, Ala., to cost $300,000. The Western Electric Company, New York, will build an addition to its Hawthorn, Ill., works, to cost $1,300,000. The Wurlitzer Manufacturing Company, North Tonawanda, N. Y., contemplates an addition to its musical instrument factory to cost $100,000. The Shell Eastern Petroleum Products Company, an interest of the Shell Union Oil Company, New York, plans a storage and distributing plant at Sewaren, N. J., to cost $100,000.

The Reading Company (Philadelphia & Reading Railway), Philadelphia, will build an addition to its shops at Reading, Pa., to cost $700,000. The International Harvester Company, Philadelphia, plans a service building to cost $150,000. The Edison Light & Power Company, York, Pa., plans extensions in substations and transmission lines in 1929 to cost $100,000. The Gulf Oil Corporation, Pittsburgh, contemplates a refining plant near Sweetwater, Tex., to cost $400,000. The University of Maryland, Baltimore, plans a central power plant to cost $200,000. The Consolidated Gas, Electric Light & Power Company, Baltimore, plans extensions in transmission lines to Friendship, Chesapeake Beach, Md., and vicinity. The United Railways & Electric Company, Baltimore, plans a power substation to cost $40,000.

Small Orders in Good Volume Reported in St. Louis

Stock sizes of apparatus are moving in very good volume in the St. Louis district, but orders are small. There is considerable activity in the southeast Missouri lead fields and some new deposits are being prospected. A 1,200-kw. generator costing $9,000 for the southern part of this district, a lot of motors to cost $10,000 for driving auxiliaries in a new privately owned power plant, two generators of 300-kw. each, costing $4,000 each, one 750-kw. generator for attachment to an oil engine to cost $7,500 and a motor-generator set with automatic control costing $6,000 for one of the lead mining companies are all of the contracts that were reported. Construction projects are as follows:

The Missouri Utilities Company, Cape Girardeau, Mo., plans extensions in transmission lines to cost $25,000. The Missouri Clay Mining Company, St. Louis, plans a plant at Poplar Bluff, Mo., to cost $150,000. The Anheuser-Busch, Inc., St. Louis, plans an addition to the power plant at its beverage factory to cost $500,000. The Missouri Pacific Railroad Company, St. Louis, contemplates an addition to its engine house and shops at Poplar Bluff, Mo., to cost $100,000. The Weatley Brothers Brass & Metal Works, Tulsa, Okla., plans a plant to cost $70,000. Gate, Okla., plans an improved lighting system. The Coca-Cola Company, Atlanta, Ga., plans a bottling plant at Morrillton, Ark., to cost $80,000.

The Dermott Gin Company, Dermott, Ark., plans an electric-operated cotton gin to cost $35,000. The Arkansas Power & Light Company, Pine Bluff, Ark., plans a transmission line from Stuttgart to Clarendon, Ark., and Brinkley, Ark., and vicinity, to cost $90,000. The Reed Roller Bit Company, Houston, Tex., will make extensions in its oil equipment manufacturing plant to cost $100,000. The Gulf States Utilities Company, Beaumont, Tex., plans extensions in the street lighting system at Port Arthur, Tex. Temple, Tex., plans an ornamental lighting system. The Ozark Chemical Company, Tulsa, Okla., plans a sulphuric acid plant at Pecos, Tex., to cost $200,000. Abilene, Tex., plans a floodlighting system and beacon lamps at the proposed municipal airport to cost $100,000. The Morriss Aviation Industries, Inc., Dallas, Tex., plans an aircraft plant in the Love Field district to cost $100,000.

Power Company Business Leads on Pacific Coast

Power company business continues spectacular on the Pacific Coast. The Pacific Gas & Electric Company's $11,000,000 station, a steam plant project in San Francisco, to be completed this year, is the outstanding inquiry. Other inquiries cover one carload of 55,000-volt insulators valued at $12,000 for installation in the Santa Rosa and Napa Valley districts, $4,750 worth of steel pins and saddles, and $1,000 worth of externally operated switches. Power company orders are featured by $10,000 worth of 500,000-circ.mil three-conductor paper and lead 4,500-volt sector cable, $11,000 worth of No. 1/0 sector cable and $40,000 worth of General Electric automatic welding equipment.

San Francisco reports much prospective hotel work, such as the $3,000,000 addition to the Stewart, the $1,000 addition to the St. Francis and $1,500,000 new wing of the Mark Hopkins.

The inclement weather and the unusual amount of snow which has blanketed the entire Northwest for the past ten days are materially interfering with business, reducing construction and other activities to a minimum. Central station and industrial buying was practically nil; the only orders reported were for seven motors from 50 hp. down for a Puget Sound sawmill addition, a 40-hp. motor and two 3-in. pumps for the city of Wenatchee and a few scattered small size motors to woodworking plants in Seattle and Tacoma. The city of Seattle bought $125,000 lb. of copper wire for $23,662, 5,000 insulators and 10,000 ft. of signal cable and called bids for 1,200 ft. of 5,000-volt lead-covered cable. Bids were opened at the Puget Sound Navy Yard, Bremerton, for an 800-kw. motor-generator set costing $30,000 and for a pier for airplane carriers taken under advisement. A contract was awarded for furnishing $130,000 worth of auxiliary generating equipment for a scout cruiser now under construction, including generators from 300 kw. down and motors from 50 hp. down. A $1,000,000 sugar beet factory is planned for Spokane and construction contracts were let for the lumber and pulp project of the Vancouver Kraft Company, Ltd., at Port Mellon, B. C., on the Howe Sound. Construction projects are as follows:

The Standard Oil Company of California, Los Angeles, plans a gasoline plant at Inglewood, Calif., to cost $100,000. The Pacific Electric Railway Company, Los Angeles, plans a power substation at Los Nietos, Calif., to cost $45,000. The Boeing Airplane Company, Seattle, Wash., plans a branch plant at Van Nuys, Calif., to cost $150,000. Alturas, Calif., contemplates a municipal electric light and power plant to cost $75,000. The San Diego Consolidated Gas & Electric Company, San Diego, Calif., plans an equipment and service building, to cost $150,000. The Pacific Gas & Electric Company, San Francisco, will make additions in its local steam-operated electric power plant to cost $10,000,000. The Glendale Glass Tile Company, Glendale, Calif., will build a plant to cost $75,000. The Eastern Oregon Light & Power Company, Baker, Ore., plans an automatic power substation to cost $50,000. Seattle and Renton, Wash., plan ornamental lighting systems. The Olympia Veneer Company, Olympia, Wash., plans an addition to its mill to cost $100,000. The Great Northern Railway Company, Seattle, Wash., plans a power plant at its shops to cost $30,000.

Business in Middle West Continues Active

General business in the Middle West continues on a satisfactory basis. Month-end reports indicate that January closed well, with an increase over last year's figures. Industrial activity is noticeably large, with increased production in the steel and automotive industries. The railroads are coming into the market for more and more equipment, one road placing an order for 30,000 tons of steel rails. The utility companies continue to contribute to the general good business, commitments running high, those of one large utility company averaging $105,000 per day. Some interesting orders that have been placed include switchgear equipment to cost $360,000, six 5,000-amp., 625-volt nominal rated rectifier units complete to cost $300,000, flues, uptakes, air ducts, etc., valued at $52,000, thirteen 3,000-amp, 60-cycle reactors and several construction orders aggregating $100,000. Jobbers' sales have been good and further improvement is expected with milder weather. Construction projects are as follows:

The Aluminum Goods Manufacturing Company, Manitowoc, Wis., plans an addition to cost $100,000. The Industrial Controller Company, Milwaukee, plans an addition to cost $100,000. The Detroit Edison Company, Detroit, plans a power substation on Second Boulevard to cost $400,000. The Gagnier Fibre Products Company, Detroit, will build an addition to cost $80,000. Vassar, Mich., plans an addition to its municipal lighting plant and waterworks pumping station to cost $30,000. The Murray Corporation of America, Inc., Detroit, will make expansions at its automobile body works to cost $5,000,000. The E. & T. Fairbanks Company, East Moline, Ill., plans an addition to its scale manufacturing works to cost $100,000. The Athletic Shoe Company, Chicago, plans an addition to cost $125,000. The University of Chicago, Chicago, will build a power plant to cost $1,000,000. Evanston, Ill., plans an ornamental lighting system to cost $1,500,000.

The Empire Oil & Refining Company, Chicago, plans an oil refining plant at East Chicago, Ind., to cost $10,000,000. The Riverside Power Company, Davenport, Iowa, plans an addition to its power plant, near Bettendorf, Iowa, to cost $1,000,000.

Activities of the Trade

Control Companies Merge

Announcement is made of the formation of the Time-O-Stat Controls Company, through the consolidation of the Leachwood Company, Janesville, Wis.; the Time-O-Stat Corporation, Milwaukee; the Absolute Con-Tac-Tor Corporation, Elkhart, Ind., and the Cramblet Engineering Corporation, Milwaukee. A plant is being built at Elkhart, Ind. Officers of the Time-O-Stat Controls Company are as follows: Julius K. Luthe, president and treasurer; A. I. Wallace, Paul K. Cramblet, E. J. Leach and Roy W. Johnson, vice-presidents. The Time-O-Stat Controls Company will manufacture a varied line of automatic controls, including regulators for boilers and furnaces, automatic refrigerators, blower and stoker controls, mercury electric switches, metal bellows, thermostats and sign flashers.

Lighting School for Architects at Nela Park

On January 28 to 30 the annual conference of lighting specialists was held at the Nela School of Lighting at Nela Park, Cleveland. This conference was mainly attended by architects, numbering well over one hundred, from various parts of the country.

L. E. Kern of the structural service department of the American Institute of Architecture was one of the principal speakers. Several other nationally known architects spoke on information architects desire from illuminating engineers. Lighting from the architectural point of view was ably discussed by National Lamp Works specialists, including Ward Harrison, director of illuminating engineering; James E. Ketch and Walter Sturrock, lighting specialists.

The purpose of this conference was to acquaint architects with the most modern thoughts in domestic and commercial lighting.

Refrigerator Men Outline Expansion Program

Two three-day conferences, one of apartment house managers and the other of advertising and sales promotion managers, were held at the refrigeration department of the General Electric Company, Cleveland, January 14 to 16 and January 21 to 23. These conferences were called to outline the expansion program for 1929.

At the apartment house conference it was learned that more than $128,000,000 was spent during 1928 for electric refrigeration.

"Electric refrigeration has had a tremendous acceptance and we expect that the apartment business will be three times as great in 1929 as it was in 1928," J. J. Donovan, manager of the apartment house division of the General Electric Company, stated. Mr. Donovan also stated that the kitchenette apartment is moving down into the business section. A safe estimate is that one-third of all domestic refrigerators sold in 1929 will be for apartments, and it is already estimated that in 1929 apartments will be built to take care of the needs of about 225,490 families.

At the advertising and sales promotion conference L. R. Edwards, manager of the advertising division, reviewed the advertising campaign of the General Electric Company and showed what an important relation advertising has to merchandising. He stated that in May, 1927, the total business done by the electric refrigeration department was $6,000. In May, 1928, the amount increased to one-quarter to one-half million dollars per day. Although advertising was not completely responsible for this tremendous increase, still it was one of the important factors which cannot be overlooked, according to Mr. Edwards.

THE IDEAL ELECTRIC & MANUFACTURING COMPANY, Mansfield, Ohio, manufacturer of direct-current and alternating-current power apparatus, announces the removal of its Boston office from 80 Boylston Street to the Rice Building, 10 High Street. The office will continue to be in charge of A. E. Murphy.

THE SQUARE D COMPANY, Detroit, manufacturer of electrical safety devices, has appointed R. P. Taylor, assistant sales manager of its company in Boston, as sales manager for its New England district.

THE B. B. T. CORPORATION OF AMERICA, Atlantic Building, Philadelphia, announces that W. G. Treiber, airport lighting specialist in charge of sales for its company, has been appointed general sales manager in charge of its district representatives, and will also continue to maintain the direct contact in special airport lighting problems.

THE CINDERELLA WASHING MACHINE COMPANY, Cleveland, is placing on the market a small portable washing machine, known as the "Cinderella." The top of the washing machine is nickel plated and the porcelain tubs are made in bright green, blue, red and ivory.

Westinghouse Announces Enlarged Advertising Program

A SUBSTANTIALLY larger advertising program for 1929 in the technical, trade and business publications, as well as in the daily papers, is planned by the Westinghouse Electric & Manufacturing Company. A statement to this effect was given out by J. C. McQuiston, general advertising manager for the company. Rotogravure advertising will be resorted to on a large scale in newspapers and all advertising will be co-ordinated for each of 35 metropolitan areas.

The list of business and technical magazines selected by the company is well over 150, covering practically every American industry. In addition, as in the past the leading state farm papers will be used for such advertising as is applicable to the rural community. Financial publications are also to be used. For general institutional and consumer advertising the company will use newspapers extensively, as in the past two years. This program, however has been considerably expanded, in line with the general increase.

The entire campaign is to be based, first, on the development of community markets through newspaper advertising; second, on the development of industrial and trade markets through business paper advertising, and, finally, to co-ordinate and time all advertising to suit the seasonal and territorial demands. A major feature of the program is a definite tie between advertising and sales efforts.

In a recent talk before editors and executives of the McGraw-Hill organization Mr. McQuiston emphasized the basic value of the technical and industrial papers of the country and is continuing the use of these media on a greatly expanded basis during the coming year.

THE ROYAL ELECTRIC COMPANY, Chelsea, Mass., manufacturer of electric fuses, lamps, etc., has appointed Bulcher & Wolpin, 55 West 42d Street, New York City, as sales representatives in the metropolitan district for the sale of Royal crystal glass top fuses.

THE CENTURY ELECTRIC COMPANY, St. Louis, manufacturer of alternating-current motors and fans, announces the removal of its San Francisco office to 621 Rialto Building, Mission and New Montgomery Streets. The company also announces that its Denver, Colo., office is now at 1700 Sixteenth Street.

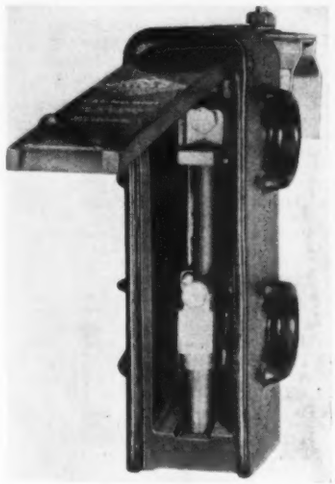
THE DELTA-STAR ELECTRIC COMPANY, 2400 Block Fulton Street, Chicago, manufacturer of high-tension equipment, and the Monarch Electric Company, St. Johns, Que., Canada, have formed an association whereby the Canadian factory will now have full advantage of the Delta-Star designs, engineering and research facilities. A complete line of unit type standardized equipment will be produced at St. Johns for Canadian distribution.

New Equipment Available

Matthews Develops New "Fuswitch"

A wet process porcelain housing fuse switch called the "700" has been announced by the W. N. Matthews Corporation. The new device is mounted on an adjustable crossarm hanger mounted on the top of the housing. Test values give a dry flashover value of 43,500 volts, a wet flashover value of 20,000 volts and a rupturing capacity of 3,000 amp. The nominal rating is 2,500/4,400 volts and 60 amp.

The bottom of the box is made of



bakelite hinged to the back of the housing. The cartridge is inserted into this bottom, so that when the cartridge is pulled it swings downward and can be removed for re-fusing. Entrance wires can be inserted from either or both sides of the housing. Patented brass contact tubes are inserted in the entrance holes and through the female contact mountings, serving as anchors for the switch mounting. Contacts are the flat surface spring pressure type. The horn fiber cartridge, when mounted in the hinged bottom, provides the Matthews double vacuum for extinguishing the arc when the fuse blows. The door is made of bakelite and hinges on top so that the interior may be inspected without disturbing service.

Voltage and Fuse Tester

A low-priced voltage and fuse tester of watch case size, known as the Johnson fuse tester, has been placed on the market by the Electric Tester Manufacturing Company, 346 Sherlock Building, Portland, Ore. The new model is both a safety device and a practical tool for use in industrial plants and in the electrical trade for locating blown fuses, dead sockets, short circuits and grounds.

The tester consists of a resistor coil and other parts inclosed in a heat resistant and non-conducting circular case, 2¼ x 1 in. in size. A 6.2-volt indicating lamp burns dimly at 100 volts and brightly at 250 volts. The tester is supplied with either 6-in. or 18-in. flexible leads.

Commutator Mica Undercutter

A new motor-driven mica undercutter has been produced by the Ideal Commutator Dresser Company of Sycamore, Ill. Since the new machine can operate in a space only 3½ in. wide no time need be lost in dismantling brushes, brush boxes, brush rigging, etc., nor need any time be spent in reassembling before putting machines back into service. It is claimed that this saves from one to three hours on every job.

Producers of the Ideal undercutter state that the machine will not heat, jump or chatter.

Light Duty Drills for Electrical Work

A new light duty electric drill designed for a number of various uses in the electrical field is announced by the VanDorn Electric Tool Company, Cleveland, Ohio. The new tool is for intermittent work rather than continuous production drilling and is light and compact. The drill is equipped with universal motor operating on either direct or alternating current and has hardened alloy steel gears, chuck, cable and attachment plug.

Magnetic Switches Have Larger Wiring Space

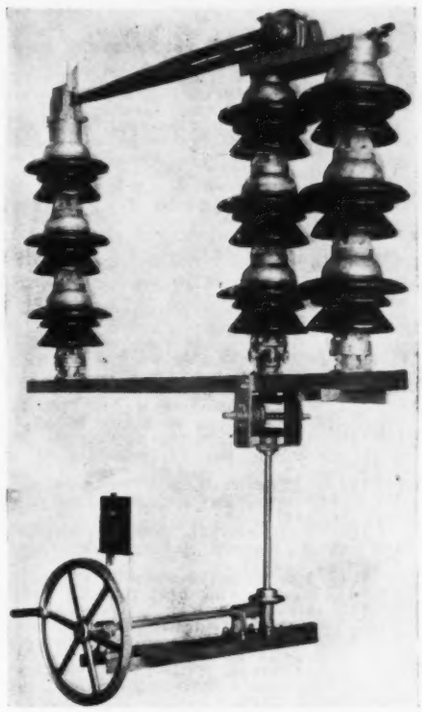
Two new switches have been added by the General Electric Company to its general line of general purpose starters for small alternating-current motors. One is a three- and four-pole magnetic switch with self-contained start and stop stations and the other is a switch for similar service, especially designed to provide plenty of wiring space.

The first of these is of standard design, incorporating features for overload protection and under-voltage protection or release. It is for starting and protecting small alternating-current motors that can be thrown directly on the line and consists of a triple-pole barrier type contactor and a double coil temperature overload relay, all mounted on a molded base in a drawn-shell steel-inclosing case. The second, although for the same general class of application, is designed for use with remote push-button stations. The principal advantage is the especially large amount of wiring space provided.

Disconnecting Switch Has Safety Feature

A new disconnecting switch, type 180 (180 deg. blade travel), has been developed by the Electric Power Equipment Corporation of Philadelphia for 110, 132, 154, 187 and 220 kv. lines. It is made in single or multiple pole for single throw with ground or double-throw operation, there being a slight increase in phase spacing for double throw.

The installation of the new switch may be either upright or inverted on a structure and 45 deg. mounting for special conditions. The contact clips are sealed tightly from ice or sleet in



both open and closed positions. It is manually or electrically operated. The new development eliminates separate ground switch and interlocks.

Motor Protector for Small Motors

The Burke Controller Corporation of New York announces a motor protector for small motors. It is designed to protect single- and split-phase fractional horsepower motors against overload, burnouts due to stalled motors and centrifugal switch failures. It is reset electrically from any point in the motor circuit by opening and closing the circuit.

When an overload or fault continues in a motor for a predetermined time the motor protector operates and shuts down the motor. On alternating current this is accompanied by a signal in the protector that takes the form of a violent buzzing. Standard capacities are built for ⅛- to ⅓-hp. motors and special orders are filled from 1/50- to 1-hp. motors.

Electrical Patents

Announced by U. S. Patent Office

(Issued January 15, 1929)

1,699,096. PROTECTIVE ARRANGEMENT; F. T. Coldwell, Alplaus, N. Y. App. filed April 1, 1927.

1,699,106. SYSTEM OF MOTOR CONTROL; R. D. Given, Leamington, and W. J. Pool, Rugby, England. App. filed April 12, 1927.

1,699,113. CONTROL OF VAPOR ELECTRIC DEVICES; Y. Matunaga, Tokyo, Japan. App. filed Oct. 9, 1926.

1,699,122. CONTROL SYSTEM; H. T. Seeley, Philadelphia, Pa. App. filed Jan. 31, 1927.

1,699,125. RELAY; H. M. Stephenson, Fort Wayne, Ind. App. filed Oct. 21, 1924.

1,699,126. FLOW METER AND THE LIKE; L. W. Thompson, Schenectady, N. Y. App. filed Oct. 7, 1924.

1,699,128. CONTROL OF DISTANT POWER STATIONS; H. E. Warren, Ashland, Mass. App. filed May 28, 1926.

1,699,141. MEANS FOR CONNECTING THE INSULATING AND METAL PARTS OF INSULATORS; W. H. Goodman, Kensington, London, England. App. filed Sept. 4, 1925.

1,699,142. HIGH-REACTANCE TRANSFORMER; A. B. Hendricks, Jr., Pittsfield, Mass. App. filed April 28, 1928.

1,699,144. ELECTRIC SWITCH; J. D. Hilliard, Schenectady, N. Y. App. filed Nov. 23, 1922.

1,699,150. INDUCTION-MOTOR ROTOR; H. Maxwell, Schenectady, N. Y. App. filed March 30, 1928.

1,699,153. SYSTEM OF DISTRIBUTION; A. H. Mittag, Schenectady, N. Y. App. filed Sept. 12, 1923.

1,699,172. MULTIPLE SWITCH; J. F. Weiland, Otter Creek, Iowa. App. filed Jan. 4, 1926.

1,699,211. WIRE CONNECTER; J. K. Rose, Chicago, Ill. App. filed Jan. 10, 1927.

1,699,214. ELECTRIC SWITCH; G. Wheat, Marlboro, Mass. App. filed Aug. 25, 1926.

1,699,280. OUTLET-BOX CONNECTER; M. M. Clayton, Baden, Pa. App. filed June 7, 1926.

1,699,292. HIGH-TENSION TRANSFORMER; W. Hess, Basel, Switzerland. App. filed Aug. 15, 1927.

1,699,317. THERMOSTATIC CIRCUIT CONTROLLER; C. A. Stilwell, Ionia, Mich. App. filed May 8, 1926.

1,699,323. ELECTRIC HEATER; P. F. Apfel, Seattle, Wash. App. filed Oct. 19, 1926.

1,699,342. MEANS FOR RAISING THE FLASH-OVER VOLTAGE OF BUSHING INSULATORS; A. O. Austin, Barberton, Ohio. App. filed Aug. 3, 1922.

1,699,404. INVERSE TIME-LIMIT RELAY; W. H. Petersen, Ludvika, Sweden. App. filed Dec. 1, 1926.

1,699,405. ELECTRICAL HEATING APPLIANCE; A. Pfau, Jr., San Francisco, Calif. App. filed July 24, 1926.

1,699,409. SWITCH-OPERATING DEVICE; C. J. Stevens, Saginaw, Mich. App. filed Sept. 7, 1927.

1,699,414. OUTLET BOX AND SUPPORT; M. Weinstein, Passaic, N. J. App. filed Nov. 25, 1927.

1,699,426. PLUG; L. H. Emery, Fairfield, Me. App. filed Oct. 24, 1927.

1,699,434. METHOD OF UNITING METALLICALLY THE SEAMS OF ALUMINUM-PLATED SHEET IRON, AND VESSEL MANUFACTURED AFTER THIS METHOD; F. Jordan, Wickede-on-the-Ruhr, Germany. App. filed Nov. 12, 1927.

1,699,446. DRY CELL; H. W. Porth, Brooklyn, N. Y. App. filed June 12, 1925.

1,699,455. PROTECTIVE MEANS FOR CURRENT-RECTIFYING SYSTEMS; B. F. Steiger, Newark, and W. A. Heppner, Red Bank, N. J. App. filed Dec. 14, 1927.

1,699,491. PUSH-BUTTON-SWITCH CONSTRUCTION; C. Miller, New York, N. Y. App. filed Dec. 11, 1925.

1,699,506. ADJUSTABLE INDUCTANCE; H. T. Faus, Lynn, Mass. App. filed May 12, 1928.

1,699,509. CONTROL OF ARC LIGHTS; P. R. Bassett, Brooklyn, N. Y. App. filed May 24, 1922.

(Issued January 22, 1929)

1,699,517. ELECTRIC SWITCH; J. S. Baker, Chicago, Ill. App. filed Oct. 23, 1922.

1,699,547. CONTACT DEVICE FOR ELECTRIC-CLOCK SYSTEMS; H. Schnurrenberger, Zug, Switzerland. App. filed Oct. 27, 1925.

1,699,580. PRIMARY BATTERY; W. A. F. Bleeck, South Brisbane, Queensland, Australia. App. filed Nov. 4, 1925.

1,699,602. RECTIFIER FOR ALTERNATING CURRENTS; E. C. Ballman, St. Louis, Mo. App. filed Feb. 10, 1923.

1,699,610. ELECTRIC HEATING AND COOKING APPLIANCE; E. R. del Riccio, Rome, Italy. App. filed Dec. 20, 1927.

1,699,626. SAFETY SIGNALING APPARATUS; T. J. Olson, New Rockford, N. D. App. filed March 2, 1926.

1,699,628. DYNAMO-ELECTRIC MACHINE; C. A. Parsons and J. Rosen, Newcastle-on-Tyne, England. App. filed Aug. 27, 1927.

1,699,633. STORAGE BATTERY; F. L. Sears, Nicholasville, Ky. App. filed March 3, 1927.

1,699,663. BURGLAR-ALARM TRAP; S. B. Hess, New York, N. Y. App. filed Dec. 19, 1925.

1,699,685. ELEVATOR SIGNALING SYSTEM; E. P. Butusov, Hollywood, Ill. App. filed Nov. 12, 1926.

1,699,690. CONNECTER; C. W. Dake, Chicago, Ill. App. filed Feb. 8, 1926.

1,699,722. ATTACHMENT FOR ELECTRIC PLUGS; W. J. Stott, Worcester, Mass. App. filed Dec. 29, 1925.

1,699,737. ELECTRICAL HEATING ELEMENT; W. W. Hicks, San Francisco, Calif. App. filed June 27, 1927.

1,699,738. ELECTRIC WATER HEATER; A. J. Kercher, Berkeley, and W. W. Hicks, San Francisco, Calif. App. filed May 17, 1926.

1,699,739. ELECTRIC AIR HEATER; A. J. Kercher, Berkeley, and W. W. Hicks, San Francisco, Calif. App. filed Sept. 16, 1926.

1,699,744 and 1,699,745. CONDENSER TERMINAL; R. E. Marbury, Wilkinsburg, Pa. Apps. filed Aug. 3, 1921, and Aug. 18, 1923.

1,699,748. RAILWAY CONTROL SYSTEM; N. E. North, Sale, England. App. filed June 24, 1924.

1,699,752. THERMAL RELAY; K. C. Randall, Edgewood, Pa. App. filed March 26, 1925.

1,699,753. SWITCH MECHANISM; A. Rawling, Ulleskelf, York, England. App. filed Nov. 30, 1926.

1,699,756. CONTROL APPARATUS; S. B. Schenck, Wilkinsburg, Pa. App. filed Feb. 5, 1927.

1,699,759. ELECTRICAL METERING SYSTEM; J. O. Shepherd, Atlanta, Ga. App. filed April 21, 1924.

1,699,762. CONTROL SYSTEM; B. H. Smith, Swissvale, Pa. App. filed Feb. 3, 1925.

1,699,763. HIGH-TENSION TRANSFORMER; H. B. Smith, Worcester, Mass. App. filed Oct. 1, 1925.

1,699,769. CIRCUIT INTERRUPTER; D. Ulrey and L. N. Crichton, Pittsburgh, Pa. App. filed July 3, 1926.

1,699,771. TESTING DEVICE; N. A. Wahlberg, Wilkinsburg, Pa. App. filed April 8, 1924.

1,699,776. WINDOW-LATCH DEVICE; R. Borden, Xenia, Ohio. App. filed Feb. 15, 1926.

1,699,777. ELECTRICAL MEASURING INSTRUMENT; A. Callsen, Nuremberg, Germany. App. filed July 17, 1926.

1,699,782. ELECTROMAGNETIC RELAY; J. Erickson, Chicago, Ill. App. filed July 27, 1925.

1,699,787. COUPLER FOR TRAIN LINES; W. T. Gray, Timperley, Chester, England. App. filed Jan. 11, 1923.

1,699,788. ELECTRICAL MEASURING INSTRUMENT; E. H. Greibach, Pittsburgh, Pa. App. filed Oct. 20, 1927.

1,699,790. CONTROL APPARATUS; H. C. Jenks, Wilkinsburg, Pa. App. filed May 25, 1925.

1,699,797. CONTROL SYSTEM; P. L. Mardis, Edgewood, Pa. App. filed Oct. 5, 1926.

1,699,802. THERMAL RELAY; A. J. Mottlau, Pittsburgh, Pa. App. filed Oct. 9, 1926.

1,699,804. COVER FOR WATTHOUR METERS; W. G. Mylius, Wilkinsburg, Pa. App. filed March 28, 1927.

1,699,807. ELECTRICAL MEASURING INSTRUMENT; R. T. Pierce, Millburn, N. J. App. filed Nov. 7, 1927.

1,699,812. LIQUID-LEVEL-INDICATING SYSTEM; J. D. Sartakoff, New York, N. Y. App. filed June 29, 1926.

1,699,825. WIRE-TERMINAL CONNECTER; A. F. Waltz, Brooklyn, N. Y. App. filed July 17, 1926.

1,699,829. SPARK INTENSIFIER; J. M. Bartley, Long Beach, Calif. App. filed March 16, 1928.

1,699,858. CONTACT FINGER FOR ELECTRICAL CONTROLLERS AND SWITCHES; R. V. H. Russell, Niagara Falls, N. Y. App. filed April 17, 1926.

1,699,866. MAGNETIC LIFT; W. Werner, Mexia, Tex. App. filed July 6, 1925.

1,699,876. ELEVATOR SIGNALING SYSTEM; E. P. Butusov, Hollywood, Ill. App. filed May 1, 1925.

1,699,898. ELECTRIC HEATER; E. N. Lightfoot, Wauwatosa, Wis. App. filed July 15, 1927.

1,699,900. VIBRATING CONTACT REGULATOR; F. Mauron, Baden, Switzerland. App. filed Dec. 19, 1927.

1,699,922. METHOD AND APPARATUS FOR INDICATING THE CONDITION OF FOOD SUBSTANCES; G. C. Robinson, Douglaston, and C. G. Harrel, Jamaica, N. Y. App. filed Aug. 24, 1927.

1,699,940. THERMOSTATIC SWITCH; A. O. Appelberg, Stockholm, Sweden. App. filed March 21, 1923.

New Trade Literature

SAFETY APPLIANCES.—Catalog No. 3 issued by the Mine Safety Appliances Company, Braddock Avenue and Thomas Boulevard, Pittsburgh, describes and illustrates all of the safety appliances manufactured by the company for industrial as well as mining purposes.

STARTERS.—Bulletin No. 113 issued by the Monitor Controller Company, Baltimore, describes and illustrates the Monitor alternating-current automatic starters.

ELECTRICAL METALLIC TUBING.—The Steel and Tubes, Inc., electrical division, Cleveland, a subsidiary of the Republic Iron & Steel Company, has issued a booklet covering its "Steeltubes" electric metallic tubing, a threadless thin wall conduit.

OIL CIRCUIT BREAKERS.—The Pacific Electric Manufacturing Company, 5815 Third Street, San Francisco, is distributing bulletin No. 21 which covers the Pacific type JC-17 oil circuit breaker and also describes the Pacific type MS-2 motor control mechanism and the Pacific current transformers. Illustrations, wiring diagrams, outline drawings and dimension tables are included.

ELECTRICAL RESISTANCE ALLOYS.—The Driver-Harris Company, Harrison, N. J., is distributing catalog R-28, which was compiled as an aid to those upon whom rests the responsibility for the proper selection of alloys used in manufacturing processes. It contains data and specifications pertaining to alloys for electrical resistance and gives photographs, descriptions, tables and technical data fully describing the Driver-Harris "Nichrome" and other alloys.

CONTROL APPARATUS.—The Cutler-Hammer, Inc., Milwaukee, is distributing a second edition of publication DE-1 entitled "Modern Valve Control Practice," describing the C-H automatic valve control system. It contains photographs showing the use and installation of motor-driven valves. These views are grouped by applications graphically demonstrating the service rendered in power plants, water plants, gas plants, etc. The operation of all valves throughout the plant by means of push-buttons from a single centralized control board is included as well as the construction and the operation of the C-H motor-driven valve-operating units.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency are desired in Tientsin, China (No. 35,910), for outside electric advertising.

Purchase and agency are desired in Montreal, Canada (No. 35,817), for flashlights.

An agency is desired in Johannesburg, South Africa (No. 35,893), for automobile incandescent lamps.

Purchase and agency are desired in Georgetown, British Guiana (No. 35,890), and another (No. 35,891), for household electrical appliances.

Purchase is desired in Edmonton, Canada (No. 35,930), of airport lighting equipment.

Purchase is desired in Chihuahua, Mexico (No. 35,888), of lighting fixtures and supplies, especially chandeliers and another (No. 35,932), of telephone-line material.

Purchase is desired in Eilenburg, Germany (No. 35,931), of magnetos in lots of 100, 200 and 500.

Purchase is desired in Zurich, Switzerland (No. 35,892), of electric refrigerator cabinets and units.

An agency is desired in Queensway, England (No. 35,894), for enameled copper wires.